Ministry of Economy, R. Bulgaria

German Agency for Technical Co-operation (GTZ)

Center for Economic Development (CED)

Analysis of the Bulgarian Technology Development

Working Paper

Sofia

January, 2001

Table of contents

List of Tables and Figures

Methodological Notes

This analysis was drawn within the project Macroeconomic Framework for Technology Encouragement in Bulgaria and is aiming to outline the major tendencies for the technological development of the country in the recent years. The Project is being carried out in compliance with the Framework Treaty Between the Governments of the Republic of Bulgaria and the Federal Republic of Germany. The parties to the Project are respectively the Ministry of Economy on the behalf of Bulgaria and the German Society for Technical Co-operation (GTZ GmbH) on the behalf of Germany.

The study fulfils the information requirements of the project and is a key stage to attaining its major goal: Development of Macroeconomic Framework for Technology Encouragement in Bulgaria. Therefore, the presentation cannot be expected to fit into the format of a perfect printed edition. All materials are presented as their authors submitted them and there were no attempts to fully harmonise the stylistic layout of the research. The major merits of the text are the analyses and the information presented. The authors' team is made up of experts in the respective areas, whereas most of the analysis and the methodology were developed by the Center for Economic Development with the consulting assistance and co-operation of the Frauhofer Institute, Berlin.

The objective of this analysis is to outline the major tendencies observable in the technological industries of Bulgarian economy during the recent 3-4 years, making, in parallel, a comparative survey of the corresponding indicators and factors typical for Germany, the EU and some of the state-applicants for EU membership.

The approach of the research aims at producing a set of practically oriented results and at structuring the presentation in such a way as to cover a maximum number of factors influencing the technological development of Bulgaria. The analysis uses the so-called SWOT method (Strengths, Weaknesses, Opportunities and Threats), where the strengths and the weaknesses are usually linked to the characteristics of the environment internal to the industry (for instance, the technological level of the industry, the availability of qualified specialists, etc.) and the opportunities and threats are related to the environment external to the industry (the existence of modern infrastructure, the quality of the educational system, etc.). Where the scope of the research focuses on the level of individual industries and industry groups, no clear-cut distinction can be made between the environments interior and exterior to the industry, which might give rise to variations in treatment and overlapping of strengths and opportunities, , weaknesses and threats. Therefore, in order to avoid a purely theoretical dispute in this respect (which is not the objective of this analysis), a more practical approach has been adopted and instead of discussing the strengths, the opportunities, the weaknesses and the threats, the text focuses on the achievements and problems.

Most of the data used in the analysis come from very reliable sources such as the National Statistical Institute, Eurostat, EU, the OECD, the World Economic Forum in Davos, etc. A major part of the information was structured and processed by the National Statistical Institute and the Center for Economic Development, exclusively for the needs of the present research, and has never seen prior publications and analyses. The use of the above mentioned sources exhibits some shortcomings such as the absence of finalised data on some of the indicators for the years of 1999 and 2000, but there are also significant advantages such as the opportunity for making cross-national comparisons and constructing sustainable and dynamic orders. The presented information covers most fully the years from 1996 to 1998 extending, where possible, to the third quarter of 2000.

Due to the physical impossibility to analyse all industrial and service branches within a period of two or three months, the survey focuses on the so-called high-tech industries. The choice of the high-tech industries is based on a 2-digit level of NACE (NACE is the statistical classification of economic activities of the European Union), which was rendered correspondent to the NIC (NIC is The National Industries Classification adopted by the National Statistical Institute). The higher tech and the medium-high tech industry sectors were taken from the latest classification of the OECD without making any additional research on intensity as regards scientific Research and Development (R&D) activities for these sectors in Bulgaria. The selection of high-tech services sectors was made on the basis of their links

with high-tech industries. Thus, a full compatibility and comparability of data is attained between the current analysis and the researches of Eurostat[1] and the OECD[2]. High-tech industries are grouped in the following industry groups:

Higher tech manufacturing sectors:

- NACE 30: office machinery and computers
- NACE 32: radio, television and communication equipment and apparatus

Medium-high tech manufacturing sectors:

- NACE 24: chemicals and chemical products
- NACE 29: machinery and equipment n.e.c.
- NACE 31: electrical machinery and apparatus
- NACE 33: medical, precision and optical instruments, watches and clocks
- NACE 34: motor vehicles, trailers and semi trailers
- NACE 35: other transport equipment

Higher tech sector of services:

- NACE 64: Post and telecommunications
- NACE 72: Computer and related activities
- NACE 73: Research and development

Relevant practices world-wide show that these are the industries playing the most significant role for the progress of scientific R&D activities and acting as the major factor of sustainable economic growth.

In addition to these industry groups, an analysis is presented of another four promising and structurally determining sectors, where the research is based on expert assessments and on a broader range of information sources. These sectors are not fully compatible with the methodology and the industries classification used in statistics. In some cases, such as biotechnology and automation, for instance, the so-called sectors incorporate activities from various industries and industry groups.

[1] Ibrahim Laafia, Eurostt's statistic in focus: Research and Development, Regional Employment in High Technology, No1/99 CA-NS—99-001-1EN-C

[2] Thomas Hatzichronoglou, Revision of the High Technology Sectors and Product Classification, STI Working Papers1997/2 OECD

Importance of the Technological Development for Bulgarian Competitiveness

PhD Anelia Daminaova, senior researcher, Center for Economic Development

Improving the competitiveness of the national economy, the individual industries and companies is an important prerequisite for attaining economic growth and managing the competition pressure within the EU, as well as for the country's full participation in the global distribution of labour. Improving competitiveness will result in a rise in real incomes and living standard.

In modern conditions, competitiveness characterises the potential of nations to attain high productiveness based on an innovative approach to human resource, capital and physical assets. This approach provides an opportunity to survive the challenges and hardships of free international markets. Competitiveness means the capacity of companies to manufacture products with higher quality parameters that would satisfy more fastidious customers.

In the recent years the international environment saw serious changes related to the globalisation of markets and the liberalisation of trade, which lead to a decrease in the importance of lower order comparative advantages such as cheap labour, relatively cheap electricity, availability of raw materials and production stock. A growing significance is attributed to higher rating advantages such as the capacity of countries for developing high-tech production and for producing and exporting goods with a higher degree of processing, which contain an intellectual component. Such production lines are potentially competitive and can influence the overall restructuring of the economy. This is of special relevance for Bulgaria now, as potential sources of growth are being sought.

The changes in world economy resulted in expanding the competition between companies based in different countries. This requires that all states (including Bulgaria), as well as the individual companies, implement new strategies, which would help them develop competitive advantages based on competence and innovations.

The practices of developed countries from the recent years prove undeniably that technological development is the decisive factor in forming companies' competitiveness. In the first place, the growing rates of competition must be noted, which are related to the capacity of timely intervention, thus turning time into a crucial factor. Successful companies are highly interested in drastically abridging the time-span between the original concept and the release of the subsequent product on the market. Another relevant tendency results from the segmentation of the market. Customers are getting more and more demanding, which forces companies to seek creative and innovative decisions in order to respond to specific consumer requirements. The third challenge is generated from the very nature of competition, which is strongly dominated by the technological capacities. Within the dynamics of the sub-suppliers practices the companies need to demonstrate specific technological capabilities and capacity in order to qualify as sub-suppliers within the system of the large consortia and international companies. These three tendencies are not mutually exclusive: they are correlated and intertwined. Their combined action forces companies to take them into account.

These challenges determine the decisive role of innovative potential and high technologies for improving the competitiveness of companies and the economy as a whole.

A similar approach for assessing competitiveness was used in the Global Competitiveness Report of the World Economic Forum in Davos, which also covered Bulgaria for two consecutive years (1999-2000). The methodology of the Forum was developed by a team headed by Prof. Jeffrey Sachs and Prof. Michael Porter. The goal was to form a competitiveness index, which would serve as a basis for ranking countries. The major factors influencing competitiveness are: state government and the effectiveness of the institutions; finance; liberalisation of the economy; quality of the infrastructure; innovative potential and technological development; working force; corporate strategies and domestic competition.

These factors contain over 200 indicators, some of which are quantitative and are determined on the basis of official statistical information. Another group of factors is assessed by business media representatives. To this end, the Center for Economic Development conducts researches among Bulgarian and foreign companies. Business representatives can give scores from one to seven (with 7 being the highest score). This approach allows for combining quantitative data with the subjective views of business as regards the competitive conditions in the country.

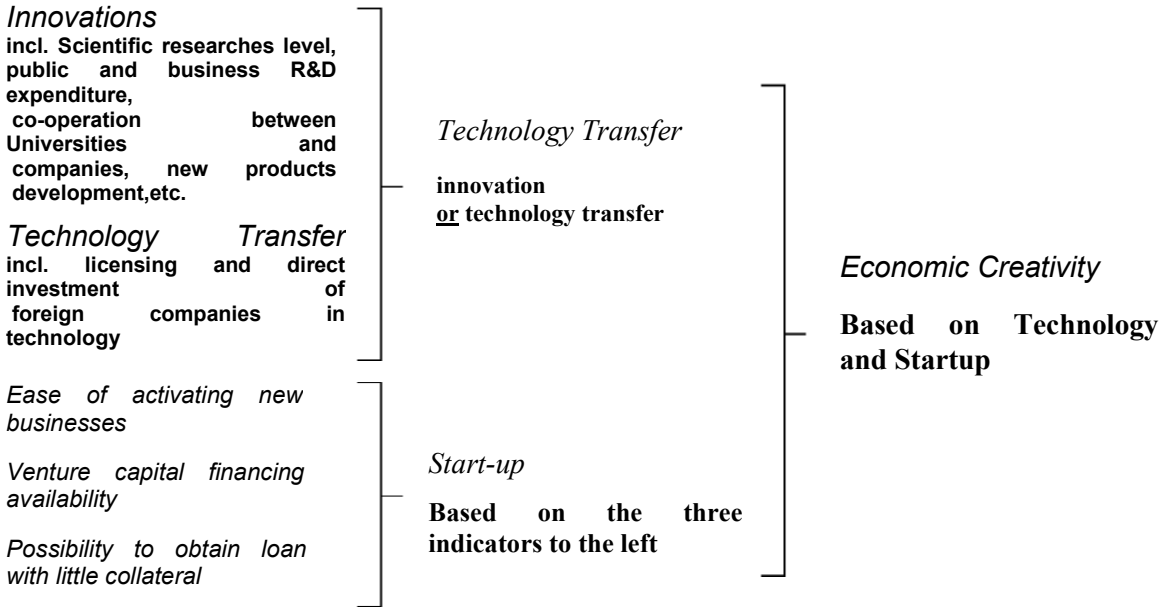
The companies' sample is representative to a sufficient extent as the companies have been picked by various criteria:

- different sectors of the economy;
- type of ownership;
- scale (based on the number of employees);
- exports orientation.

The sample contains mainly companies with over 500 employees (64.5%) where the share of private companies is far higher than the rest: over 80%. The processing industries occupy the largest share (50.6%). There are also agricultural and construction companies, transport and telecommunications, education, public administration and financial intermediation companies. According to the methodology applied, the core of economic growth and competitiveness of the countries is the innovative capacity and the effective diffusion of modern technologies. This applies especially to the countries' potential to improve their competitiveness and attain higher economic growth in the future or their so-called economic creativity.

Figure 1 shows a diagram of the formation of economic creativity of a country. The relevant methodology was developed by Andrew Warner from the Harvard University and was published in the Global Competitiveness Report 2000 of the World Economic Forum in Davos. There are two major factors for the economic creativity of the countries.

Figure 1 Economic Creativity Formation Mechanism



Source: The Global Competitiveness Report 2000, World Economic Forum

The first and most important factor is the technological development of the country, which is based either on the country's potential to generate innovations or on its capability of adapting new technologies (technological transfer). There are two major approaches for technological transfer: direct foreign investment or licensing. The second major criterion is characterised by the opportunities of launching a

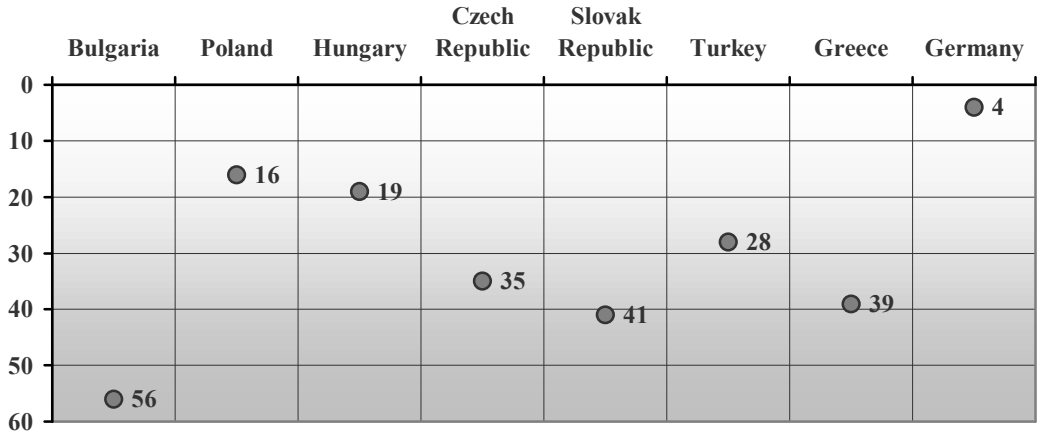
new business within the country and is related mostly to the economic investment and administrative environment.

Bulgaria's participation in the Global Competitiveness Reports of the World Economic Forum allows for a comparative analysis of the country's competitive positions to those of some of the countries in Central and Eastern Europe (mostly countries from the first wave of accession to the EU) as well as for an outline of the competitive advantages and disadvantages of Bulgarian economy. A comparison to the previous year's parameters is also possible, which would allow identifying the indices on which Bulgaria's positions have improved. Bulgaria's ranking in the overall competitiveness rating is not favourable. The main reason for this is related to the negative positions of the country as regards the innovative potential and technological development. This factor is most significant in forming the assessment of the countries' competitiveness and determines their potential to generate economic growth and attain higher production rates.

The negative positions as regards technological development provide, once again, a reason for putting an emphasis on the opportunities for improving the environment for Bulgaria's high-tech sector development and reaffirms the topical references of this project.

Regardless of how technological development is being carried out – either through innovative approaches (i.e. the countries generate innovations themselves) or through a transfer of modern technologies from abroad, the result is the same: higher productiveness and higher competitiveness. It is worth noting that, as regards technological development, Bulgaria is lagging considerably behind some other Central European countries such as Hungary, the Czech Republic, Poland, Slovakia, and some of its neighbours such as Turkey and Greece. These countries do not avail of sufficient potential to generate innovations themselves, but they have much more successfully transferred high technologies from outside and introduced them into practice. This predetermines their much better ranking in reference to technological development and overall competitiveness. Under the ***Technology Index*** Poland ranks 16th, Hungary is 19th, the Czech Republic is 35th, Slovakia is 41st, whereas Bulgaria is only 56th. If we look at our neighbours, it is worth noting the 28th and the 39th positions of Turkey and Greece respectively.

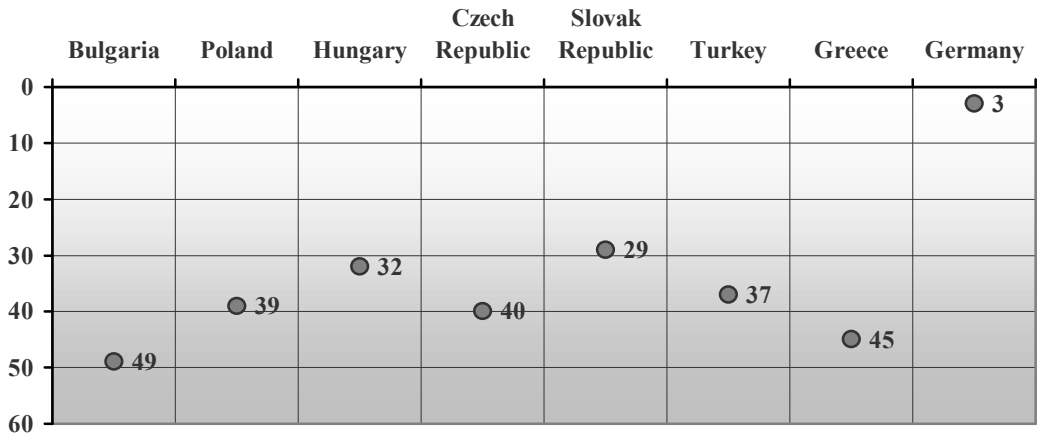
Figure 2: Technology Index: Competitiveness Ranking 2000



Source: The Global Competitiveness Report 2000, World Economic Forum

The above countries demonstrate even better positions under the ***Technology Transfer Index.*** They rank as follows: Poland is 6th, Hungary is 8th, the Czech Republic is 24th, Slovakia is 37th, Turkey is 15th, and Greece is 32nd, whereas Bulgaria again occupies the unenviable 56th position.

Figure 3 Technology Transffer: Competitiveness Ranking 2000

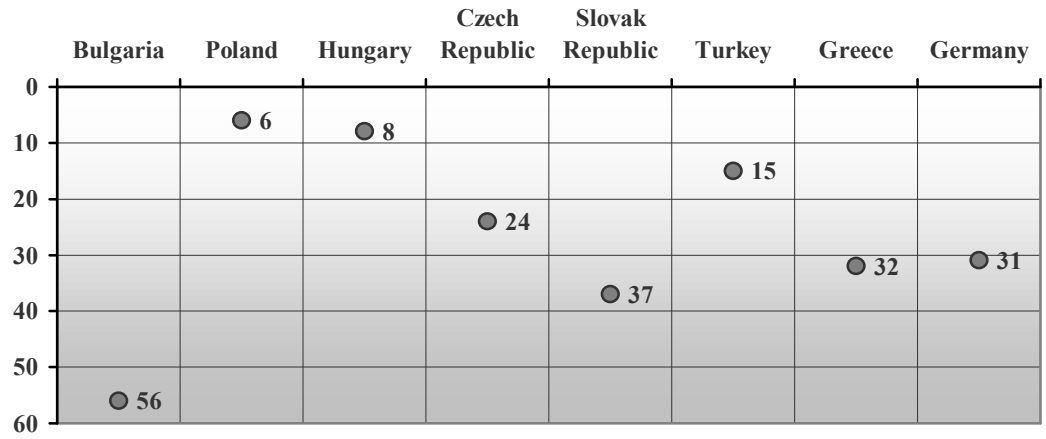


Source: The Global Competitiveness Report 2000, World Economic Forum

Most of the countries shown in the figure (and mainly Poland, Hungary and Turkey) pursue an aggressive policy in absorbing modern technologies from outside and introducing them into practice. This policy makes them highly successful in improving their competitiveness.

It is a fact that modern competitive economies are based on innovative potential and technological development. It is also a fact, however, that Bulgarian companies set up their strategies mainly on lower costs based on cheap and relatively qualified labour as well as cheap raw materials. The companies from the leading countries in the competitiveness rating rely mainly on the products diversification based on modern technologies and design and on the high quality of their services and servicing. Under the Innovations factor Bulgaria occupies the 49th position, Poland is 39th, Hungary is 32nd, the Czech Republic is 40th, Slovakia is 29th, whereas Bulgaria is 56th. Our neighbouring countries, Turkey and Greece, for instance, occupy the 37th and the 45th positions respectively.

Figure 4 Innovation Index: Competitiveness Ranking 2000



Source: The Global Competitiveness Report 2000, World Economic Forum

As we speak of Bulgaria's advantages, they are demonstrated mainly in the area of labour: this is the factor driving the country to the highest positions. Labour is assessed as regards the relatively high level of school education and some existing flexibility in the labour market, etc. As a competitiveness factor, however, cheap labour is a short-lived and uncertain advantage, which cannot withstand other factors, and, mostly, innovations and technologies. The generalisations from the analysis of the changes during

the past two years show that Bulgaria has attained better achievements as regards the openness of its economy, which is liberalised to a considerable extent, the quality of the labour force and the financial system. The negative changes are related to technological development, some elements of state government and the institutions.

Table 1 Competitiveness Balance of Bulgarian Economy

Competitiveness indicators whereby positive changes have occurred	**Competitiveness indicators whereby negative changes have occurred**
Technological Development ➢ Private sector costs for development and research activities; ➢ Co-peration between institutions in the area of scientific research; ➢ Education in exact sciences	***Technological Development*** ➢ Low purchases of licenses for technologies transfer; ➢ Intellectual property protection; ➢ Distribution of personal computers; ➢ "Brain Drain"
Openness of the Economy ➢ Foreign trade regime liberalisation; ➢ Average level of customs tariffs; ➢ Stable currency exchange rates	***Openness of the Economy*** ➢ Import barriers ➢ Undeveloped export encouragement practices
Finance ➢ Stabilisation of the banks; ➢ Regulation and supervision of financial institutions; ➢ Private sector share in the banking system	***Finance*** ➢ Difficult access to credits; ➢ Poor activity of the stock exchange; ➢ Low degree of development of financial markets; ➢ Lack of venture capital
State Government of Institutions ➢ State administration competence; ➢ Effectiveness of police action	***State Government of Institutions*** ➢ Difficulties in starting a new business; ➢ Existence of administrative barriers; ➢ Complicated bureaucratic system; ➢ Taxation system and tax payment; ➢ Corruption
Infrastructure ➢ Telephone lines distribution; ➢ Domestic transportation value	***Infrastructure*** ➢ Internet; ➢ E-trade use; ➢ Access to information
Human Resource ➢ Rules for regulation of salaries; ➢ Unemployment insurance; ➢ Freedom in determining salaries; ➢ Relation between labour remuneration and the productivity of labour; ➢ Quality of school education	***Human Resource*** ➢ Health services quality; ➢ Employees/management relations; ➢ Unemployment; ➢ Employment increase
Company Operations and Domestic Market Competition ➢ Anti-monopoly policy; ➢ Regulatory standards; ➢ Product Design; ➢ Sales under own trade mark	***Company Operations and Domestic Market Competition*** ➢ Marketing activities quality; ➢ Competitive advantages based not on high technologies, but on cheap labour; ➢ Consumers not demanding enough

Source: The Global Competitiveness Report 2000, World Economic Forum

Competitiveness of the Technological Environment in Bulgaria

Ivaylo Gueorguiev, researcher, Center for Economic Development

The current analysis will be mainly based on the competitiveness assessment methodology, which was used by the World Economic Forum (The Global Competitiveness Report), and which was developed with the participation of Professors Michael Porter and Jeffrey Sachs of Harvard University. Their reports are based both on a specially construed company management survey, which was carried out simultaneously in all the participating countries, and on comparable statistical information about the individual countries.

The Bulgarian technological environment is considered from three perspectives:

- Bulgaria's position versus the position of different types of countries, e. g. the Czech Republic, Germany, Greece, Hungary, Poland, Russia, Slovakia and Ukraine, using data from the Global Competitiveness Report 2000 (Survey data in the Report date from March 2000, and statistical data - from 1998).
- Development of Bulgaria's growth competitiveness ranking on the basis of The Global Competitiveness Report 1999 and The Global Competitiveness Report 2000.
- Analysis of the indicators of the technological sector and presenting information from other sources.

Factors and indicators of the technological sector in Bulgaria

The indicators assessing Bulgaria's competitiveness (see Appendix 1 Table 27) contain a high-level Tertiary education enrolment indicator used by UNESCO for education assessment. According to this indicator, Bulgaria is followed by countries like the Czech Republic, Hungary, Poland, Slovakia, Turkey and Ukraine, and it is behind Germany, Russia and Greece.

The assessment of Bulgarian company managers of education in mathematics and in the fundamental sciences in Bulgaria is traditionally high - 4.84 (max 7). It is a positive fact that in spite of the difficult situation of Bulgarian education, the assessment has increased by 2.3% compared with 1999.

The development of education in mathematics and in natural sciences used to be a primary objective of the former Soviet block countries, which determines the similar ranking of a large number of countries in this area; Bulgaria is followed by Poland and Greece, and has the similar ranking as Germany, Russia, Slovakia, Turkey and Ukraine.

The high level of education in fundamental sciences is a good prerequisite for the technological development of Bulgaria, but the country should hardly compensate for the backwardness in practical training in information and telecommunication technologies, which is the result of the inadequate material basis of the Bulgarian educational establishments. The education ministry's *Draft Programme for school education in information and communication technologies and for their implementation in the process of education*[3] makes an assessment of the current status of Bulgaria's education in the area of information and communication technologies, and focuses on the following aspects:

- the outmoded equipment and its quality does not allow the implementation of modern education and the use of information and communication technologies;
- the syllabi cover education content, which was mostly topical in the 80-ies;
- databases, computer simulation, multimedia and Internet are rarely used;
- the majority of teachers in subjects other than IT lack the necessary skills to use information and communication technologies in their work.

[3] http:/www.minedu.government.bg/informationbg/ict%20programme1.htm

Consequently, the Bulgarian education system is too theoretical, and in spite of the high level of education in fundamental sciences - mathematics, chemistry, etc. - it is not currently in a position to contribute to Bulgaria's future technological development.

Considering that the consequences of education needs some time to manifest themselves, and that they influence Bulgaria's competitiveness in a long-term plan, **education could turn into the main threat to the country's competitiveness regarding the new technologies**.

If Bulgaria wants to preserve its comparatively high competitiveness in high technologies, the Society must actively step in and invest in the education system. More funding must be allocated for modernising the information and communication technologies in Bulgarian schools and universities, and for motivating and attracting experienced specialists to work there. That **process must be regarded not as a social undertaking but as an investment in human resources whose return is very high and indisputable**. Along with producing skilled personnel in the area of high-tech development, education must also generate a higher demand by creating highly qualified consumers of information and telecommunication technologies. A programme must be adopted and financed for training in information and communication technologies on the school level; the programme must be implemented as soon as possible and it should be targeted both at the students and at the teaching staff.

The survey amongst Bulgarian company managers ranks "Scientific research institutions are truly world class" second factor - where the country is ranked 3.74 (max 7). However, the current ranking has strongly reversed (by nearly 10%) compared with the 1999 survey. The requirements of the Bulgarian companies have increased in respect of one of the comparison criteria - Bulgaria's openness to the international scientific community - and this is one of the reasons for the 10% drop in the ranking. An interesting international development is the fact that in spite of Bulgaria's significant drop in the above-mentioned assessment, the country is placed in 34th position (35th in last year's ranking) - which shows that the lower level of this indicator is typical of countries having positions close to that of Bulgaria - the Czech Republic, Greece, Poland and Turkey.

In the last ten years, a large number of Bulgaria's leading institutes failed to adapt themselves to the market environment, and their activities as R&D centres gradually disappeared. In the same period, the market of R&D services suffered significant changes:

- Due to financial restrictions in the conditions of a currency board, and to the decentralisation of the economy sectors, public procurement for such activities has declined, reaching a critical minimum.
- The former large-size line research institutes, which are characterised by a high level of expenditure, ineffective management and obsolete material basis, cannot provide specialised services for the private sector in the conditions of a growing competitiveness of foreign consulting and design companies operating in the country.
- Currently, most of the research projects are placed by international sponsors who prefer to operate with Western consultants, and in most cases the Bulgarian institutes act as sub-contractors only.
- A new generation of small companies and research organisations is emerging, establishes by leading specialists in the respective sectors. The founders are for the most part highly skilled experts of vast experience in the respective area, who have split up from the huge research and design institutes. Most of these new units are characterised by flexible management, innovative thinking, and entrepreneurial spirit but are still in their initial phase of growth.
- The market of R&D products and services is increasingly oriented towards applied research, which is targeted and sponsored by external firms and organisations, contrary to the State-funded fundamental research in the past.

By following the market trend and the inherited positive preconditions, the setting up of technological and research incubators of ideas and firms at the established R&D centres would allow for a gradual and

effective restructuring of Bulgaria's R & D that will help to increase the applied research at a higher market cost. Practice in the developed countries shows that this is also job-creation tool[4].

After 1989, Bulgaria's public expenditure in R&D, as a percent of its GDP, went down, and shrank much more than in the other ex-Eastern block countries. Here, Bulgaria is better placed than its neighbours Greece and Turkey. On the other hand, due to its intensive R&D policy, Greece might have caught up with Bulgaria in 2000, and as for Turkey, it can be assumed that the low level of R&D expenditure per GDP is the result of having R&D concentrated in that country's European territory. Practice in OECD countries shows that there is a direct link between the levels of government support and private investment in R&D[5]; therefore, the level of that indicator could be considered as a threat to the development of technologies in Bulgaria.

A positive tendency is observed in businesses in connection with a vast range of issues pertaining to the opinion of managers about the importance of R&D for the success of the companies they manage. On the questions concerning co-operation in R&D, private investments in R&D, and the licensing of technologies as a means for Bulgaria's technological renovation, the ranking of Bulgaria has gone up by 12, 8 and 2 positions respectively. There are possibilities for economic growth here - by creating conditions for turning the existing potential into practical measures by the private business and by the State. Compared with the other base countries, Bulgaria's position is not yet satisfactory. Compared with Poland, Russia, Turkey and Ukraine, Bulgaria ranks better on some of the mentioned indicators.

All the countries participating in the present survey, except for Germany, rank very close on the question " It is important for company to do its own R&D"; Bulgaria is in somewhat better position than the Czech Republic, Poland, Turkey and Ukraine.

It is the assessment of the business that the general technological level in Bulgaria has made little and insufficient progress, which places Bulgaria last compared with the remaining nine countries.

The deficit of highly qualified specialists is a main obstacle to the high-tech activities development on a world level. That deficit, which is particularly high in information technologies and electronics, determines the migration of well-trained Bulgarian specialists to the developed countries.

The tendency is registered by the Bulgarian company managers as well, who place Bulgaria last (2.12) on the item "Talented people remain in the country" compared with the other items on technologies. Compared with the rest of the countries participating in the survey of the World Economic Forum, Bulgaria still ranks 58 in the above quoted index.

Bulgarian specialists will stay in the country only if they are offered conditions for work and advancement that are similar to those of their colleagues abroad. Promoting relations between universities, research institutes and the business will improve the environment and the prospects for specialists to begin work immediately upon graduation.

Information and communication technologies

In order to achieve a rapid and stable economic growth, Bulgaria must build a modern and reliable information and communication network, both on the institutional and on micro level. Undoubtedly, a leading role in the process will be played by Internet communications, which until recently were labelled as "high technologies" but are referred today as infrastructure, i. e. they are not a "technological" but a "compulsory" condition for modern business activities and way of life.

Taken by itself, Bulgaria could be said to develop fairly well in the area of the information and communication technologies. The country's rate of growth by some of the Internet-related and wireless-

[4] Ibrahim Laafia, Eurostat's statistic in focus: Research and Development, Regional Employment in High Technologies, No. 1/99 CA-NS-99-001-1EN-C

[5] (Dominique Guellec and Bruno van Potterlberghe de la Potterie, Does Government Support Stimulate Private Sector?, OECD, Economics Studies No. 2, 1997/II)

communication indices reaches dozens of percentages. At the same time, the country's ranking in most of these indicators has deteriorated (see Appendix 1, Table 28), which means that **in Bulgaria, information technologies develop slowly than in the other countries**.

Table 28 (Appendix 1) shows that compared with the other nine countries, in the area of Internet Bulgaria is followed only by Russia and Ukraine, and by number of Internet hosts it is followed by Turkey alone. Regarding indices showing the use of electronic mail, Internet for information and Internet for supplies, Bulgaria gets close enough to Poland, the Czech Republic, and Hungary respectively, but does not excel them.

Bulgaria has a vast human resource potential for information technology development and traditions in this domain. Because of these factors, the development of Internet communications and of the business environment in Bulgaria should be considered as a possibility for future growth, and the low indices should not be regarded as a threat. Of course, in order to use this possibility and to prevent it from turning into a threat, efforts will be needed that will exceed those of the other European countries.

The well-developed telecommunication infrastructure is a good prerequisite for growth of the information technologies. By telephone posts density and by meeting the demand in new telephone lines, Bulgaria occupies good positions among the CEE countries. In these indices, the country is followed by Poland, Russia, Slovakia, Turkey and Ukraine; the country's saturation of standard telephone posts per 100 individuals is close to that of Hungary. Moreover, Bulgaria's telephone network is currently being upgraded, and modern digital technologies are introduced. This reflects on the high degree of digitalisation of the network, except for settlement transfer and settlement exchange.

Table 2 Degree of digitalisation of the telecommunication network by 31.12.1998 (in %)

Long-distance transmission	78.0
Long-distance switching	78.6
International transmission	95.5
International switching	100.0
Local transmission (junction networks)	25.8
Local switching (main telephone lines)	7.0

Source: Bulgarian Telecommunication Company

The comparatively low quality of services for end-users and the high price of long-distance calls, that are typical of a State monopoly, could be determined as a threat.

The existing monopoly explains the low ranking of mobile communications, too. At the moment, there are two mobile operators in the country, which are not in direct competition because of the important differences in the technologies they use.

The experience of the European Union Member States in the telecommunications market shows that **the introduction of free competition on the telecommunication market is the main tool for boosting growth**.

In this connection, the main conclusion of the Ministerial Conference on the information society and on speeding-up the process of European integration, which was held on 12-13 May 2000 in Warsaw, was: "... twenty-two months following the introduction of free competition, the regulatory framework has been driving the market of telecommunication services in the Member States towards growth, a larger number of participants in the market, and lower tariffs"[6].In the near future, an improvement of the competitive environment in the sector can be expected in connection with the privatisation of BTC and the prospects for two new mobile phone operators using the GSM technology.

[6]http:/www.is2000.pl/documents.ncx [On Selected Policy Issues]

Transport infrastructure

The well-developed railway transport is a basic element of Bulgaria's transport system. Bulgaria is a country with a very well developed railway network; unfortunately, in the last years the importance of that factor has declined, and the Bulgarian State Railways (BDZ) have increasingly become dependent on government subsidies. Bulgaria ranks 25 by length of railway network, leaving its neighbours Greece and Turkey behind. Unfortunately, Bulgarian managers assessed the development of the railway transport as not very important, which is probably due to the difficulties faced by BDZ at the time of the survey. Currently, BDZ is in the process of restructuring, and a change in the environment may be expected.

Similar is the state of affairs in the road network, where Bulgaria is in the 44th position; however, because of the bad maintenance of roads, Bulgarian managers place Bulgaria 54th by road maintenance. Bulgaria is ahead of Russia in road network indices, and leaves Ukraine behind in road maintenance.

Air transport is cheaper in Bulgaria than in the countries listed in Appendix 1, Table 29, except for Greece and Russia; however, Poland and Slovakia alone follow Bulgaria in respect of the frequency and effectiveness of air transport.

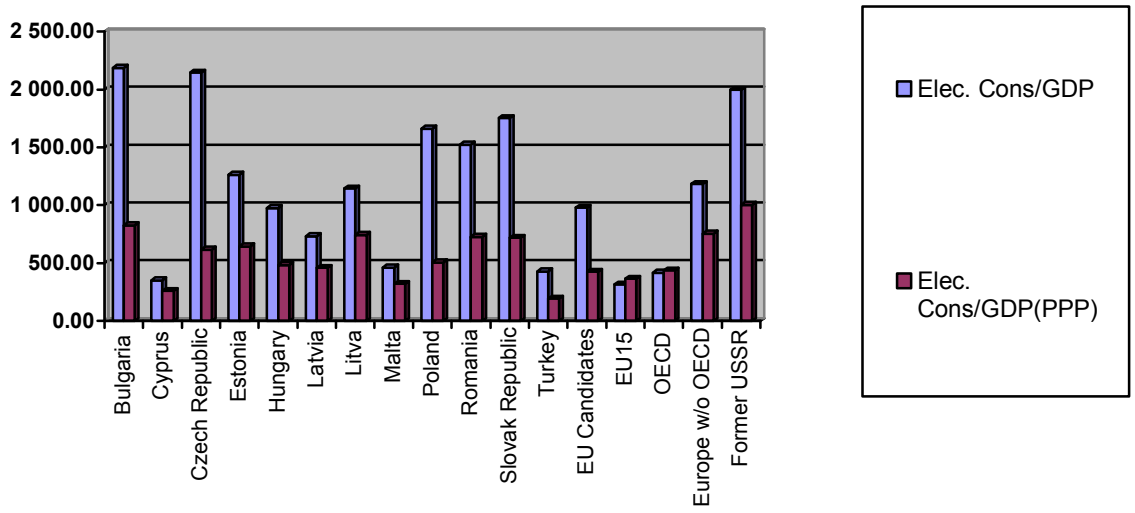
Bulgarian ports get a better assessment in Bulgaria than ports in Hungary and Poland; the assessments of the former socialist countries as a whole are similar.

Indirect indicators of the technological development - energy intensity of the GDP

An indirect indicator of Bulgaria's overall technological level is the intensity of the Gross Domestic Product (GDP) in respect of the energy carriers used for its creation. A typical characteristic of the new technologies is the fact that they use natural resources in a more effective and more rational way, and produce higher-quality goods that are more expensive. It is logical to suppose that in the countries that use modern technologies for processing and manufacturing, the ratio between the used energy resources and the produced GDP is better. Since the formation of the GDP comprises the price level in the respective country or region, the indices are also expressed by the GDP as a Purchase Power Parity (PPP). Thus, the influence of the price level is cut down as much as possible.

Figure 5 Energy intensity of GDP, toe per 1000 US$ in 1990 prices shows the energy intensity levels of the countries applying for EU membership, as well as the average levels of the European Union Member States, OECD and the former Soviet Union. According to these data, Bulgaria's energy intensity expressed by the GDP as a PPP is twice as high as that of the EU Member States and the OECD countries. The difference increases nearly six times, if energy intensity is not calculated using PPP. Here, Bulgaria is followed only by Romania, the Czech Republic and the countries of the former Soviet Union.

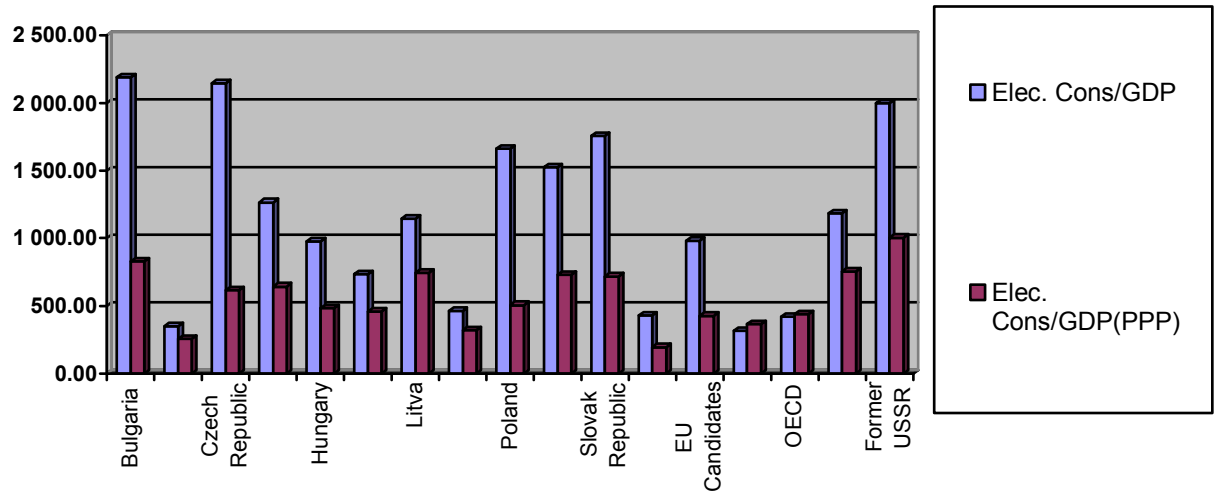
Figure 5 Energy intensity of GDP, toe per 1000 US$ in 1990 prices



Source: OECD

The proportion is similar if the level of electricity intensity is taken into consideration Figure 6.Here again, Bulgaria is one of the countries that use much electricity for the production of one unit of GDP. The Czech Republic alone has higher electricity intensity in respect of the nominal value of the GDP.

Figure 6 Electricity intensity of GDP, kWh per 1000 US$ in 1990 prices



Source: OECD

Conclusions

Taking into account the indices, which were commented in this chapter, conclusions can be drawn about some important tendencies in the technology sector in Bulgaria. These essential tendencies have a contradictory nature but it can be generally said that in spite if Bulgaria's very low technological indices, there exist possibilities for the development of technologies. These are the main conclusions:

Strengths	***Weaknesses***
➢ Well trained specialists ➢ Well developed transport infrastructure ➢ Relatively good infrastructure regarding fixed telephones ➢ Tendency towards establishment of new flexible, R&D-oriented institutes and companies	➢ Low mobile phones density ➢ Insufficient use of Internet ➢ The large research institutes face difficulties ➢ Low level of R&D expenditure on company level ➢ Weak co-operation between universities, research organisations and the business
Opportunities	***Threats***
➢ Very good education ➢ Forthcoming de-monopolising of the telecommunications market in Bulgaria ➢ The business is increasingly oriented towards R&D and the adapting of new technologies as a tool for higher competitiveness	➢ Education is not practice-oriented; the equipment for information and communication technologies is insufficient ➢ State monopoly in the country's infrastructure ➢ Low level of R&D expenditure in respect of the GDP ➢ Low technological level of the economy as a whole

The above table shows that till now, most of the weaknesses and threats to the competitiveness of the technological sector in Bulgaria are counterbalanced by positive tendencies of the strengths, and by possibilities that can neutralise threats. In order to improve the competitiveness of the technological sector, it is necessary to accelerate the positive tendencies, and to take serious measures to offset the negative ones.

Economic Analysis

Analysis of the statistics data in the general macro-economic framework for Bulgaria 1996 – 2000 compared to selected European countries

Llili Dudeva, senior researcher, Center for Economic Development

Reni Petkova, chief of department, National Statistical Institute

Major tendencies in the latest decade

The unique political and economic transformation for Bulgaria was accompanied by deterioration in the macroeconomic characteristics of the country compared with 1989. The abrupt slump of the gross domestic product in 1993 shrank in volume to below 80% compared with 1989. The increase of the GDP in 1994 and 1995 was too modest and unstable. The dynamics of this indicator turned downward again in 1996 when the greatest for the decade annual slump of 10% was registered and the inertia of the crisis that followed brought its 1997 level down to 67% of the one in 1989. (see Appendix 2, Table 30)

In the latest decade the GDP per capita decreased by an annual average of 2.53 per cent. The capabilities to finance the technological development decreased in parallel with the total macroeconomic slump. The expenses for scientific R&D in 1996 and 1997 reached the lowest level for the decade of 0.52 per cent of the GDP, following the maximum of 1.64 in 1992 in the considered period.

The introduction of the currency board from the middle of 1997 imposed new and stringent "rules of the game". The immediate result was the quick mastering of the former macroeconomic chaos – the exchange rate was put under control by tying it to the German mark, the inflation rate dropped abruptly, the economic activity became predictable. On the other hand, the macroeconomic situation in Bulgaria was seriously influenced by external factors. Their influence sharpened in 1999 as a consequence of the conflict in Kosovo, the weak demand from abroad and the unfavourable international prices. Nevertheless, functioning in the environment of a currency board, the Bulgarian economy coped better than initially expected with the external shock influences and the challenges of the internal restructuring.

In 1999 the annual growth of the GDP is 2.4 per cent.(see Appendix 2, Table 31). The more pessimistic forecasts of 1.5 per cent growth were surpassed. For comparison, the total GDP for the candidate-countries decreased by 0.2 per cent, after a 1998 increase of 2.8 per cent. In the previous years the economies of the candidate-countries as a whole feature a quicker rate of annual growth than the 15 European Community countries and for the first time since 1995 it not only drops under the GDP of the EU 15 /+2.3 per cent/ but becomes negative[1].

The engine of the growth in Bulgaria in 1999 were the gross internal investment which increased by 25.3 per cent, while their share in the GDP increased from 11.6 to 15.9 per cent. The average annual inflation was only 1.8 per cent. The budget deficit[2] was 0.9 per cent of the GDP. However, some important macroeconomic parameters deteriorated in comparison with those in 1998. The rate of economic growth slowed down form 3.5 to 2.4 per cent annually. The decline in industry and exports continued. The deficit under the current account of the balance of payments increased to – 5.2 per cent of the GDP.

Unemployment increased considerably during the year and reached 16 per cent at the end of 1999 compared to 12 per cent at the end of 1998.

Since the beginning of 2000 the economy growth accelerated - the rate of the GDP for the first and second quarter, and the first half of the year exceed more than twice the respective annual growth for the

[1] Source: Eurostat, News release No 85/2000

[2] As per GFS definition of the state management sector, which we deem more appropriate for international comparisons, there is even a surplus of 1.5 per cent of GDP.

same periods in 1999. What is new in the macroeconomic environment in 2000, and particularly important for the potential for technological development, is the turn of the trend in the industry. The situation in the international prices and foreign exchange ratios this year favoured a more active Bulgarian export. The increase in export was the main factor for the growth of industry in 2000 – the rates of industrial manufacturing have been positive for each period since the beginning of the year, compared to the respective period in 1999. However, the home market for industrial products is still shrinking.

The service sector continues to pull upward the GDP growth in the first two quarters of 2000. The industry has already joined this direction of impact on the dynamics of the economy. The investments, which increased by two-digit rates in 1998 and 1999, preserve their role as the engine of GDP growth. The greater activity in foreign trade is characterised by positive rates of export as well as of import of goods and services. It should be noted that the export of goods and services not only went from a phase of decline to phase of growth already in mid 1999, but has been developing at a higher rate than import in 2000. (see Appendix 2, Table 31)

The last few years are characterised by a stabilisation of the macroeconomic environment and transition to a faster growth. Nevertheless, Bulgaria enters the new millennium with very low starting indicators. Having $5000 real GDP per capita, Bulgaria has to gain not only on the EU member-countries, whose average GDP level is $ 21135. Greece has the lowest level of $ 14749 among them, which is three times higher than ours. Unfortunately, Bulgaria is last among all EU candidate-countries. Our GDP per capita is hardly 84% of that of Romania, which is in front of us, and only 34% of that of Slovenia which heads the list and has already overtaken Greece.

In 1998, in terms of volume of GDP per capita, measured at current prices and current purchasing power parity in parity USD, Bulgaria ranked 40 among the countries participating in the program for international GDP comparisons. The country has negotiated only two positions compared to 1990. A serious bounce in position from 1990 to 1998 was achieved by Ireland, Poland, and Turkey. All three countries have climbed by 11 degrees up the scale. Ireland has moved from 22 position to 11th position. Poland and Turkey, which in 1990 were behind Bulgaria and ranked respectively 43d and 46th , for the past eight years climbed to 32d and 35th place. It should be noted with regret that at the beginning of the transition Bulgaria was in a better position than Poland, while at present it hardly reaches 62% of its GDP per capita. In some of the years our country was also more competitive than Lithuania and Latvia. Only Macedonia and Albania are behind us in the whole group of the countries of Central and Eastern Europe.

Bulgaria in 1998 – major indicators compared to other EU candidate-countries

Compared to other EU candidate-countries, Bulgaria started the negotiations with more unfavourable macroeconomic characteristics. (see Appendix 2, Table 32)

The gross domestic product of Bulgaria /in Euro, at current prices and exchange rate/ amounts to 0.15 per cent of the GDP of the 15 EU member-countries /EU 15/ and 2.1 per cent of that of the 13 EU candidate-countries. The GDP of the candidate-countries is about 7 per cent of the EU 15 GDP. The latest data shows that these ratios remain the same in 1999[3].

GDP per capita in Purchase Power Parity(PPP) for Bulgaria is the lowest among the candidate-countries and amounts only to 23 per cent of the average EU-15 level.

Industrial production has shrunk most in Bulgaria in comparison with 1995 /decrease of 17.4 per cent/; there is decrease also in Cyprus, Romania, and Turkey. At the same time an increase of over 20 is registered in Hungary, Poland, Latvia and Estonia. Only Bulgaria and Romania have a drop for 1998.

[3] Eurostat, News release No 85/2000

Bulgaria features the lowest ratio of economic activity as well as the highest unemployment ratio among the candidate-countries.

Only Bulgaria went through a period of hyper inflation, which distorted seriously the cash flows.

The major trading partner of Bulgaria are the EU countries. However, Bulgarian exports for the EU accounts for a lower share of the total exports – 50 per cent – compared to that of Hungary /73%/, Poland /68%/, Slovenia and Romania /65%/. The imports structure features the same characteristics – the share of imports from the EU/45%/ is the lowest for Bulgaria.

At the end of 1997 only Romania is behind Bulgaria /42 ECU/ in terms of direct foreign investments from the EU per capita.

The share of expenses for R&D, expressed as percentage of the GDP for Bulgaria amounts to 0.59 per cent and is higher only in comparison with Cyprus, Latvia, Lithuania and Romania. The Check Republic stands out with 1.27 per cent and Slovenia with 1.42 per cent compared to the 1.86 per cent average for the EU-15. For comparison purposes in the USA – 2.5%, Japan – 3%, Russia – 0.90%. It is worth noting that three of the candidate-countries – the Check Republic, Slovenia and Slovakia /0.86%/ show higher shares than Greece /0.51%/ and Portugal /0.63%/, which are last among the member-countries. The Check Republic, Slovenia overtake also Spain /0.90%/ and Italy /1.02%/. The most active among the candidate-countries – Slovenia – is, though slightly, ahead of rapidly developing Ireland /1,40%/[4] .

The contribution of Bulgarian business in the financing of R&D is modest – 18.7 per cent, especially in comparison with The Check Republic, Romania and Slovakia in which the share of business contributions to the expenses for R&D even exceeds the level of the indicator for EC15 /63.7%/.

The most shocking is the change in the number of staff engaged with R&D in Bulgaria for the period 1994 – 1998. The most substantial increase in staffing among the candidate-countries shows the Check Republic – by 21.2 per cent, followed by Poland /8.8/ and Hungary /3.8%/ A decrease is observed in the remaining candidate-countries which varies between 0.7% for Slovakia to the drastic drop by 31.8% in Bulgaria. For comparison: EC15 /+3.7%/, Russia /-22.7%/.

Bulgaria: Gross added value for high-technology sectors, 1996 – 1998

The high-technology sector in Bulgaria accounts for less than 10 per cent of the gross added value in the economy[5] . The most considerable is the contribution of the medium high-technology sector. The higher-technology sector is represented the most modestly – by less than 1 per cent. The highest shares in the structure of the added value of the high-technology sector belong to "Posts and telecommunications" /code 68/ - 31 per cent, which is from the group of high-technology services. It is followed by "Production of machinery, equipment and household appliances" /code 34/ with share of 28 per cent and "Production of chemical products" /code 27/, whose share is 19 per cent. Compared to 1996, the share of "Posts and telecommunications" has almost doubled, the share of "Production of machinery, equipment and household appliances"has also increased, while that of 27th industry has shrunk nearly twice.

The ratio added value/production in the high-technology sector as a whole is lower than the general for the economy and had decreased in the period 1996 – 1998. In 1998 it is 35 per cent for the high-technology sector compared to 45 per cent for the economy as a whole. The ratio for the sub-sector of high-technology services – 54 per cent in 1998 - is higher than the one for the high-technology sector as a whole, as well as the one for the whole economy. That is entirely due to the ratio in "Post and

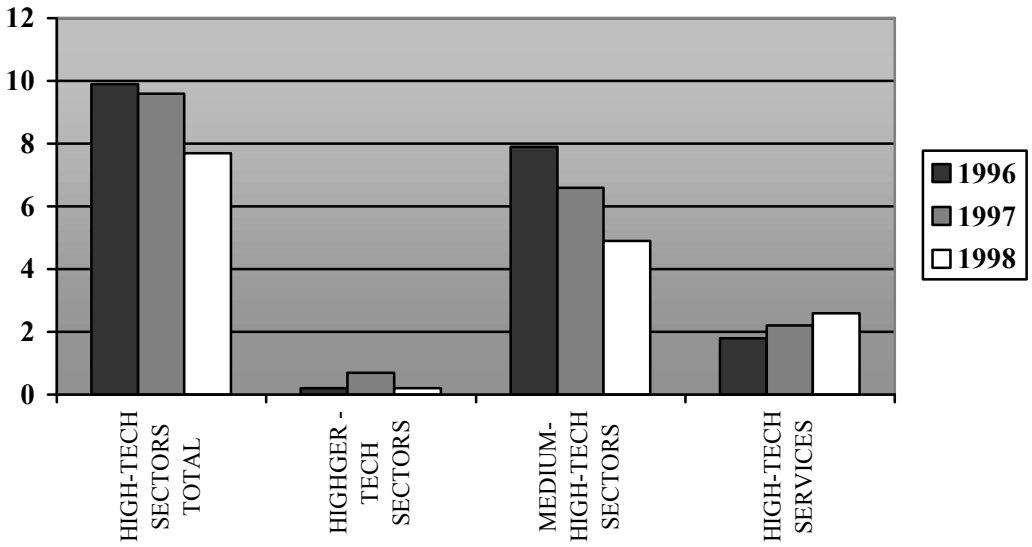
[4] Source: Eurostat, News release No 85/2000

[5] All data related to the gross added value of the high-technology sector for 1996 – 1998 are estimates of the team at the Center for economic development. The estimates of production accounts have been made on the grounds of National Statistical Institute data from reports for income and expenses of the enterprises and departments in the respective high-technology activities. For convenience the value indictors are presented in denominated levs. All estimates of the added value of the high-technology sector have been prepared on the grounds of prices for the respective year and cannot be used for analysis of the dynamics of the added value.

telecommunications" /code 68/ - 56 per cent in 1998. The least added value per production unit is created by the higher-technology sub-sector – about 27 per cent – exhibiting in addition a downward tendency in the considered three year period.

Added value at current prices per one hired person for the whole high-technology sector is lower than the added value per one hired person for the economy in each of the three years. The industries that are doing best within the sector in 1996 are "Production of chemicals" /code 27/ - 1365 denominated leva, "Production of vehicles /except cars/" /code 40/ - 648 denominated leva, and "Post and telecommunications" /code 68/ - with 600 denominated leva. In 1997 "Post and telecommunications" /code 68/ moves up to second position with 6827 denominated leva, following 27th- industry with 9662 denominated leva, and in 1998 gains leading position for added value per one hired person in the whole high-technology sector /5419 denominated leva/ and surpasses the economy as a whole /252 denominated leva/. In all three years the higher-technology sub-sector creates nearly three times less added value per one hired person /3090 denominated leva for 1998/ compared to the economy as a whole. Only "Scientific research" sector /code 77/ has lower levels of added value per one hired person – 539 denominated leva in 1998 – compared to the higher-technology sub-sector. (see Appendix 2, Table 33)

Figure 7 Share of Total Economy Gross Value Added, %



Source: National Statistical Institute

The participation of private entrepreneurship in the added value of the high-technology sector is much more modest than in the economy as a whole, but is increasing more rapidly. In the three years under consideration the private sector has increased its share in the added value of the economy by less than 10 percentage points /from 55 to 63 per cent/, while the share of the high-technology private sector has increased from 7 to 36 per cent in the whole high-technology sector.

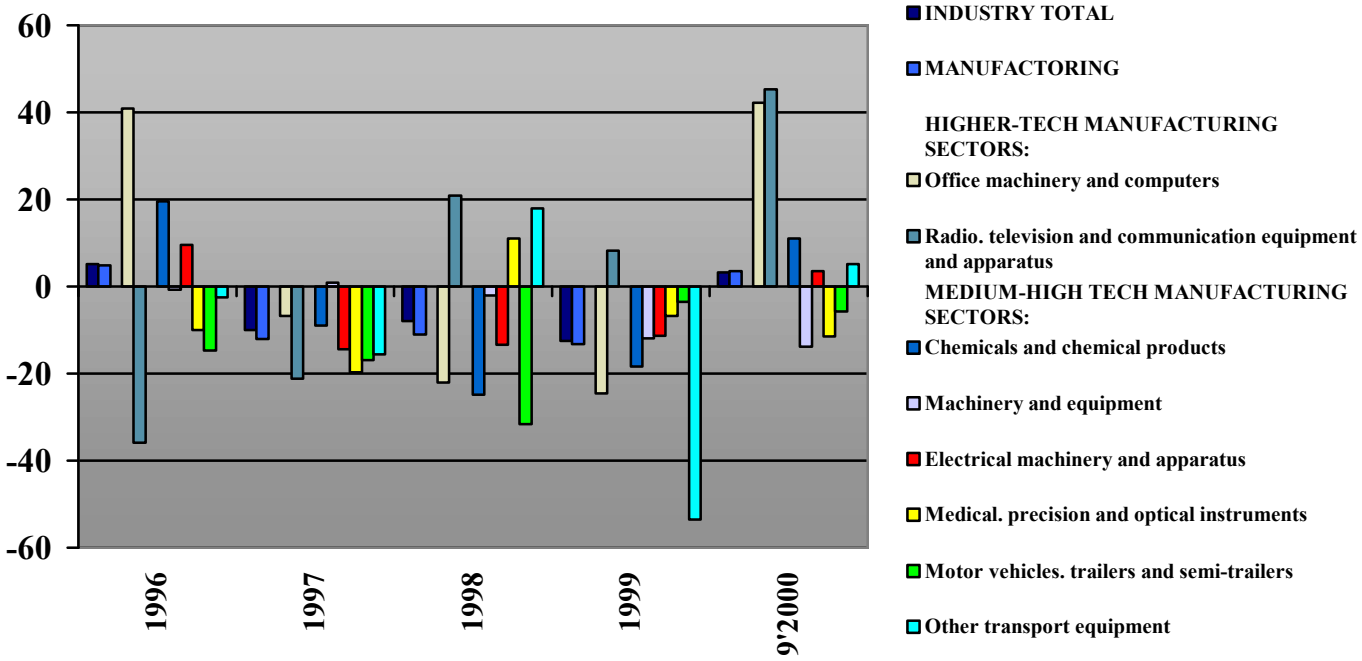
A more substantial presence of the higher-technology sub-sector can be noted within the structure of the added value of the private high-technology sector, but even there its share is the lowest, with a dominance of the medium sub-sector.

The ratios added value/production in the private high-technology sector /29 per cent in 1998/ are lower than those for the high-technology sector as a whole /35 per cent in 1998/, they are even lower than the ratios for the whole private sector in the economy /48 per cent in 1998/, the latter are, though slightly, higher than the ratios for the economy as a whole.

The dynamics of the industrial high-technology sector in Bulgaria may be followed by the rate of changes in production. (see Appendix 2, Table 34&Table 35). No data is available for similar production indexes in the sector of services.

Generally, all branches in the industrial high-technology sector are exhibiting negative annual development rates in the years 1996-1999. The only exception in two successive years – 1998 and 1999 – is the positive dynamics of the branch "Production of radio, television and telecommunication equipment" /code 37/ by respective annual rates of 21 and 8 per cent. It has been developing at very high positive rate in the first nine months of 2000 and compared to the respective period in 1999 the increase in production for the branch is by 45 per cent. Apart from that branch, positive rate of development in 2000 are exhibited by the other high-technology branch – Production of office and computing technical equipment /code 35/, whose rate for the first nine months of 2000 is 42 per cent. A recovery of the medium high-technology sector is observed – the production of chemicals /code 27/ has been on the increase in the nine months by 11 per cent, though slight, there is also an increase in the production of Electric machinery and apparatuses /code 36/ - by some 4 per cent, as well as in Transportation vehicles, excluding cars, /code 40/ by 5 per cent. Unfortunately, the decrease in all the other high-technology branches is continuing. However, the good news is that in 200 there is animation in the upper high-technology sub-sector /codes 35 and 37/, as well as in the industries determining the structure of the whole sector.

Figure 8 Production of the Industrial Enterprises and Establishments, Growth Rates 1996-2000 (since the beginning of the year over the corresponding period of the previous year, %)



Source: National Statistical Institute

Expectations related to technologies for 2000 - 2001

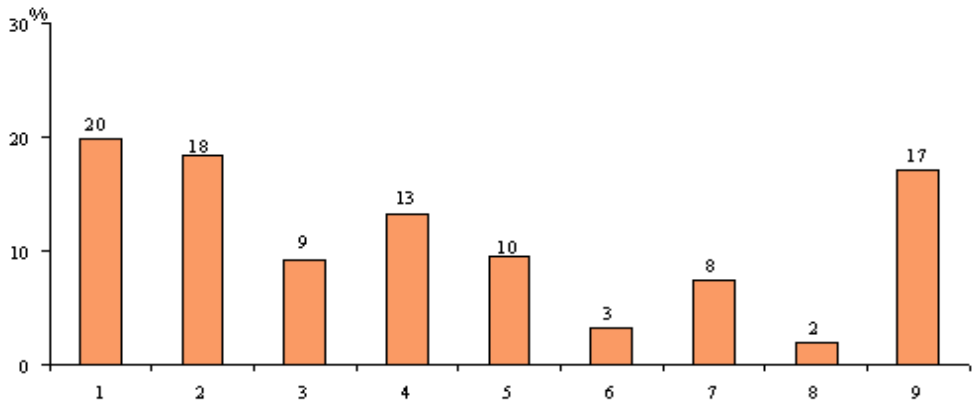
The investment business enquiry of the National Statistical Institute conducted in the second part of October this year shows that the expected increase of investments of industrial enterprises[6] in 2000 is about 10% compared to the previous year and part of the investments planned early this year have been transferred in the plans for the next year. It is expected that in 2001 the expenses for acquisition of long-term tangible and intangible assets would be equal to those of the current year, and 62% of them are expected from the enterprises in the private sector.

For the purposes of the analysis of the technological development in Bulgaria it should be noted that 23% of the investments expected for 2001 are assigned for mechanisation and automation /13%/ and for introduction of a new technology /10%/. A decrease is observed in the investment share for mechanisation and automation of the existing production process, which judging from the previous

[6] The observed enterprises account for 96% of the annual industrial turn-over

enquiry in April showed potential for the highest expected rate of development of the nominal amount, compared to 1999 (by approximate estimate – threefold, due primarily to the private sector). As a result of this expected increase, the relative share of that type of investments in 2000 came up to 26,3% for the whole Industry. There is a positive change in the share of expected investments for introduction of a new technology –5 per cent for 2000, expected to go up to 10 per cent in 2001.

Figure 9 Distribution of the planned 2001 investments by type



1. Recovery of existing equipment; 2. Increase of production capacity with unchanged product range; 3. Increase of production capacity with expanded product range; 4. Mechanisation and automation of the existing production process; 5. Introduction of a new production technology; 6. Energy savings; 7. Protection of the environment; 8. Security measures; 9. Other type of investment.

To the questions about the factors restricting mostly investment activities everybody points out high prices of investment goods – 49% share[7] of the industrial enterprises. The major factors causing difficulties for investment activities of private industrial companies are the high prices of investment goods (57% - the share of enterprises) and insufficient credit guarantees (47%). A part of the enterprises have given their explanations of the reasons in the line "other": high interest rates on loans, high tax burden, non-acceptance of investments as direct expenses, insufficient bank support; limited purchasing power of the population, difficulties in forecasting market changes etc. The enterprises that have pointed out "technical reasons" as a factor restricting investment decisions in 2001 are less than 10%.

In a very general way, these results could be interpreted to signify the availability of technical abilities and lack of financing for the implementation of a more active investment program for the industry, directed particularly to the high-technologies.

Table 3 Factors restricting investment decisions in the industry in 2001 (Relative share of enterprises - %)[8]

	Total	Mining	Processing	Electricity, gas and water	Public sector	Private sector
Insufficient demand of production	18.5	43.2	19.5	3.3	14.1	20.4
High prices of investment goods	49.1	35.5	53.9	29.2	26.8	57.3
Insufficient credit guarantees	36.5	24.2	41.8	13.7	18.5	40.4
Insufficient profits	32.7	49.2	25.7	62.9	48.1	24.6
Fear of indebtedness	14.1	18.8	13.9	13.1	11.3	14.9
Technical reasons	7.7	1.1	8.2	7.4	10.1	6.5

[7] Weighted share – the answers of the enterprises have been weighted as per the size of there turn-over.

[8] Weighted share. The sum of the percentages exceeds 100, since the enterprises have pointed more than one factor restricting investment activity.

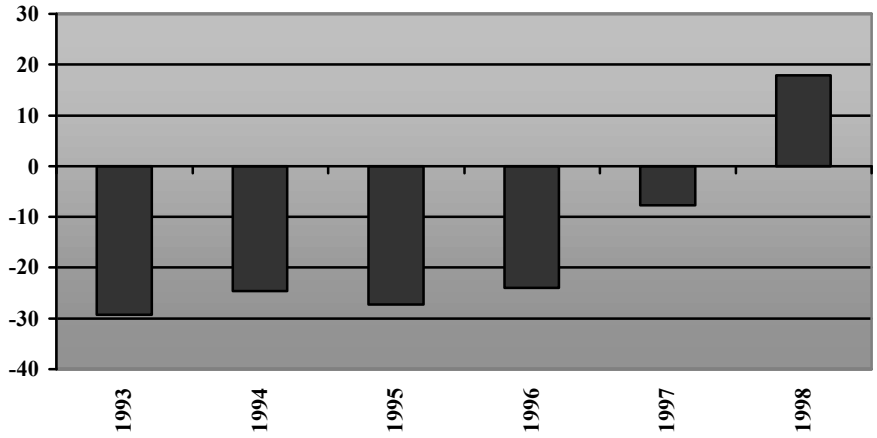
Other	7.2	1.9	6.4	13.9	12.3	8.6

Source :National Statistical Institute

The main findings of the Detailed Analysis of Technology and R&D Related Statistical Data Compared to Selected European Countries presented in Appendix 3 are shown below:

- Expenditure on R&D in the period 1993 – 1997 realized a negative, downward trend in real terms. The trend was reversed in 1998 when a 17.9% growth was reported.

Figure 10 Annual growth R&D Expenditures, %



Source: National Statistical Institute

- The sustained downward trend in R&D expenditure lead to a considerable decline in R&D intensity (measured as a percentage of R&D expenditure in GDP). In 1998 the level of this indicator was 0.59% or three times lower than the average for the EU: 1.86%.
- The sharp decline in R&D performance of budgetary-funded organizations was not compensated by research activity in the business sector. As a result the share of R&D expenditure in the business enterprise sector (BES) dropped to 18.6% against 63.7% on average for the EU. R&D personnel in BES accounted for 17.2% against EU average of 47.1%.
- R&D personnel decreased by 31.9% in the period 1996 – 1998, resulted in a reduced share of R&D personnel in the labour force: from 0.89% in 1996 to 0.62% in 1998, against EU average of 1.27%.
- Most intensive research activity was carried out in the medium-high tech I group industries, which in 1998 accounted for 48.3% of R&D expenditure and comprised 61.5% of R&D personnel in manufacturing.
- In the period 1996 – 1998 the number of employed in the high technology industries decreased by 12% against total employment decline of 4.1% in the national economy. The most significant employment decline occurred in the higher-tech industries: 26%. Employed persons in the high technology services decreased by 4%.
- Medium-high tech industries provided the greatest share of jobs in 1998: 27.7% of total employment in manufacturing. The share of employed persons in the high technology services accounted for 5.5% within the Services sector.
- In 1998 wages and salaries in the medium-high tech industries were higher than in the higher-tech ones, the latter receiving 5 to 10% lower wages than the average level in the manufacturing. Employed in the high technology services received higher wages and salaries than the country average.
- Unemployment rate in the both high technology industrial groups was higher than the country average. Higher tech industries had the highest unemployment rate: 26.0%. High technology services displayed a considerably lower level of unemployment than the country average: 5.9%.

- In 1998 investment activity in the high technology industries decreased from 1996 thus resulting in a 26.9% drop in the share of expenditure on acquisition of tangible fixed assets within the manufacturing, against 29.2% in 1996.
- In 1998 the share of foreign direct investment attracted by high technology industries decreased by 6.3% percentage points from the previous year, while the share of foreign direct investment in the high technology services rose by 6.3 percentage points.

Bulgarian Foreign Trade in High Tech Products

Marieta Tzvetkovska, researcher, Center for Economic Development

Trade in high tech products as a part of Bulgarian foreign trade

Promotion of technological development in Bulgaria is highly dependent on trade in high tech products as import ensures a supply of necessary technologies and it is through export that a part of the high tech products produced in the country are sold abroad. Increase of foreign trade and the share of export in total world exports are referred to as a major criterion for national economy competitiveness while increase of trade in high tech products is referred to as a criterion for technological development.

A picture of the Bulgarian foreign trade in 1997-1998

The development of the foreign trade of Bulgaria in 1998 was accompanied by a continuous drop in the prices of major raw materials and low processed products, the dynamics of the export being determined entirely by the situation on the international markets. In 1998 the Bulgarian foreign exchange of commodities amounted to USD 8939.9 million, which is 8.8% decrease compared to 1997. The registered foreign trade deficit of USD 316 million (FOB-FOB) was due to 13% contraction of the Bulgarian exports to the amount of USD 4139.2 million and a slight increase of imports by some 1% compared to 1997 reaching USD 4800.7 million.

In 1998 the Bulgarian export was negatively influenced by the reduced demand abroad and by the reduction in prices of chief exported products in the chemical and metallurgical sectors. In spite of the overall decrease in the value of exports, an increase was registered with many groups of products, compared to 1997. In quantitative terms the biggest increase in export – by 28.3%, was registered with exported garments and accessories, which accounted for over 10% of the overall export of products from the processing industry. Export of furniture was increased by 16.3%, which is also indicative of a re-direction towards products with greater value added but still from the group of low-tech productions. In fact these tendencies were preserved in the next two years though recently export value of chemicals and metals rose due to increased prices on international markets. In 1998 there was a considerable drop in the import of mineral products and fuels, as well as of metals. There was an increase of 31.5% for the group of machines and equipment, which showed an enhanced investment activity in the country and a tendency towards promoting technology development.

The drop in export revenues in 1998 is a proof that part of the Bulgarian economy lacks competitive power as a result of structural reform delay in the real sector of the economy, as well as, the low level of introduction of new technologies and know-how in productions. The reason for these developments is greatly due to weakly developed bank lending in the country, insufficient volume of foreign investments and weakly developed small and medium-sized enterprises sector.

The inherited inefficient structure of the economy predetermined the inefficient product structure of the Bulgarian export as well. Exports are concentrated in several major product groups – chiefly raw materials (57% of the export for 1997 and 53.3% for 1998) and products of low degree of processing, mainly labour-intensive and low tech (such as textiles and wearing apparel). In addition, some structure defining enterprises in the economy and chief exporters were still state-owned monopolists, at that time.

The reduction of revenues from exports were due to some external causes, as well:

- reduction in prices of chief exported products – metals, fertilisers, chemicals (which only comes to prove the unfavourable structure of exported products, which includes products of low level of processing, the prices of which are most sensitive to changes in the market situation);
- loss of traditional markets for some major Bulgarian export products (due to the world financial crisis a considerable reduction in demand for fertilisers was witnessed);
- delay in growth rates in the Western European countries, Bulgarian chief trading partners;
- the financial crisis in Russia (still an important market);
- the Kosovo crisis (political uncertainty in the region and problems with the transportation of export commodities).

As a positive tendency we can point out the increase in import of investment products. This is related to modernisation of the technological facilities of the economy, and hence to the improvement of the competitive power of the economy and creation of an export potential. The increase in import of investment goods in 1998, compared to 1997 totalled 27.8% (238.5 million USD). This tendency was kept during the last two years.

The geographic structure of Bulgarian foreign trade is an important indicator for the competitiveness of the national economy. Having in mind that the OECD countries occupy the leading places in Bulgarian foreign trade one can draw a conclusion about the competitiveness of the Bulgarian export. The exchange of commodities with these countries increased to 53.5% of the total 1997 exchange of commodities, and in late 1998 reached 61%, tending to grow even more during the next two years. In this way the developed industrial countries preserve and strengthen their role of a chief trade partner of Bulgaria. The fundamental re-orientation of the geographic structure of the Bulgarian foreign trade is due to the implementation of the European Agreement for Association of Bulgaria and of the additional agreements to it, thus transferring the European Union into the leading trade partner of the country over the last years. The exchange of commodities with the EU countries jumped from 40% in 1997 to 49% in 1998 and tended to grow in the next two years, exceeding 50% by now.

Other extremely important trade partner of Bulgaria is the group of the Balkan countries, accounting for 18% of the total exchange of commodities in 1998 (including Greece and Turkey); Russia - 13.3%; the CEFTA countries - 5.5%; Ukraine – 3.4%; the USA - 3.1%.

Identification of main high tech sectors of the Bulgarian economy and analyses of foreign trade in high tech products

A well known fact is that the larger the share of trade in high tech products the more competitive the national economy is. The retrospective analysis of Bulgarian foreign trade indicates that it has moved in a downward direction – from more sophisticated high tech industries such as heavy machine building, computer peripherals and specialised equipment to primary industries. The reason for the change in the industrial specialisation pattern of Bulgaria since 1990 can be found in the lost of the guaranteed and protected former CMEA markets. Now, after the collapse of the CMEA and transferring of foreign trade to new more sophisticated markets we have to identify competitive high tech sectors producing enough export production during the last years.

In the period 1997-1998 high tech exports show decrease not only in value but in share of total exports, too, while imports register an increase of almost 20% in value and in 1998 these products take more than 33% of all Bulgarian imports. Main Bulgarian high tech products exported are chemical products (about 15-18%) followed up by household appliances (5-6%) and electrical machines and apparatus (2.5%) (see Appendix 4, Table 38&Table 39). Except for the sector of transport equipment (about 2%) the share of all other high tech sectors in total Bulgarian exports is less than 1% and these are exactly the sectors referred to as higher high tech productions.

If we investigate foreign trade data in high tech products for 1997 and 1998 we can find out some main trends, both favourable and unfavourable. As positive trends can be mentioned:

- Increase of imports of high tech products not only as a total value but even more seriously as a share of all imports;
- 20% increase of imports of high tech products when all imports drop slightly;
- more rapid increase of import of cars, motor vehicles, office equipment, radio, TV and communication equipment than of chemical products and household appliances
- positive balance of trade in high tech products for 1997 which is 4 times larger than the whole positive trade balance.

As negative trends can be mentioned:

- decrease in total value of high tech exports;
- decrease in share of high tech exports in total Bulgarian exports;
- the decrease in high tech exports exceeds the decrease in all exports;
- decrease in prices of major Bulgarian high tech export – chemical products;
- negative balance of trade in high tech products in 1998 which represents 70% of whole negative trade balance.

But for the purposes of the analyses of trade in high tech products identification of high tech production sectors (see Appendix 4, Table 38&Table 39) is not enough. An in-depth analysis getting down to 3- or 4-digit or even 6-digit level of the commodity groups in order to identify not only the main high tech production sectors producing for export but also competitive high tech products possessing export potential. It is very important to know what kind of chemical products we are exporting, mainly: fertilisers, inorganic chemicals, oil products, plastics, pharmaceuticals or cosmetic products. For instance, there are about 30 high tech products among the first 100 commodities exported from Bulgaria and their share in all exports is 18% and they present 30% of the amount of these 100 export commodities. Only 11 high tech products are presenting among the first 50 Bulgarian export commodities: oil lubricants take 5.32% of all exports, soda ash – 1.57%, medicines – 1.34%. And these 50 commodities form 46% of total exports, almost half of it (see Appendix 4, Table 40&Table 41).

Competitive high tech products **regularly exported** from Bulgaria apart from oil lubricants, soda ash and medicines are tooth past, cosmetic products, antibiotics, machine spare parts, polyethylene, polypropylene, ammonia nitrogen. Some high tech products exported in the near past (till 1997) are **no longer in the export list** because of their low value added, low market prices and high import prices of raw materials for them. These are different organic and inorganic elements at lower level of processing. Due to the restructuring of major Bulgarian enterprises exports of some high tech products as ships and boats, electric power machinery, electric distributing equipment, etc. were exempted from export list after 1997-1998. And in the end, there are some high tech products **newly exported**, such as machines and apparatus for tobacco processing, hydraulic power machines, photographic materials (plaques, films, etc.).

Level of high tech development in Bulgaria can be characterised not only by exports of high tech products but by their demand markets, as well. More than 50% of total Bulgarian exports in 1997-1998 were directed towards the highly sophisticated and demanding EU market. Main markets for Bulgarian high tech products are EU countries, former socialist countries from Central and East Europe, Balkan countries (see Appendix 4, Table 42). The share of EU in Bulgaria's trade in high tech products is a reliable indicator of the competitiveness of Bulgarian production having in mind that sophisticated foreign demand for Bulgarian export goods places very high quality requirements.

The role of the foreign trade policy for the effectiveness of trade in high tech products

Bulgaria is a small country with negligible internal market for high tech products and it could hardly survive without broad access to international markets. High tech development and raising competitiveness

of national economy is highly dependent on foreign trade regime and customs tariff. This means that we need stable and predictable foreign trade policy, consistent liberalisation of foreign trade, reduction of tariffs and non-tariff barriers, further negotiation of additional trade concessions through different bilateral and multilateral agreements (more than 60% of Bulgarian foreign trade is conducted under free trade conditions, now). All these are aiming to increase the efficiency of the production and the competitive power of Bulgarian goods. The openness of the national economy towards the world economy throughout adequate foreign trade policy gives Bulgarian producers the opportunity to work in a competitive environment and makes them improve their production all the time. More detailed information about Bulgarian foreign trade regime is presented in Appendix 6.

Importance of the sector of small and medium-sized enterprises (SMEs) for the Bulgarian economy

Diana Hristozova, senior researcher, Center for Economic Development

The 1998 National Statistical Institute data shows that 92.4% of the enterprises (total number 205 643, without the private agricultural farms which do not have the status of an enterprise) are micro-enterprises, 5.41% - small and 1.05% medium-sized, i.e. about 98.5% of all enterprises come within the SME sector. For the sake of comparison, 99.8% of all enterprises in the European Union are SMEs and provide 66% of the total employment.

The biggest share of SME, by economy branches, belongs to healthcare, trade, education, hotels and public catering - from 99.78% to 99.9%, and the smallest - to production and distribution of electricity, gas, and water and the mining industry - between 65.44% and 68.32%[1]. The sector of small and medium enterprises in Bulgaria generates 48% of the total income and holds 22,8% of the long-term tangible assets of all enterprises. The increase in the number of employees in SMEs in 1998 is by 51 742 people and represents 88.74% of the reported reduction in unemployment rate for the country (58 305 p.) That fact shows that small and medium-sized businesses are getting a firm position as the major factor to reduce unemployment and generate new employment opportunities[2].

In 1998 SME account for 46.2% of the turnover of all enterprises. Their contribution to the gross value added for the same year is as follows: micro-enterprises - 9.08%, small – 9.94%, medium-sized - 6.36%, SMEs total -25,38%[3]

The achieved net profitability (expressed as a ratio of the net profit to sales revenues) for the entire economy in 1998 is 0.69%, for micro-enterprises - 3.21%, for small enterprises - 0.03%, and for medium-sized enterprises - 0.05%. It should be noted that in the period 1996 - 1998 only micro-enterprises have reported positive net profitability for all three years, while the for the entire economy in 1996 companies report negative profitability - -0.85%, and the biggest companies (with over 250 employees) report negative profitability of - -0.25% even in 1998. Generally, the data show that SMEs exhibit higher flexibility and recover much quicker after a crisis period.

The SME share in 1998 employment rate totals 44.1% (in 1996 it is 36.7%, and in 1997 - 41%) out of which: - micro - 20.5%, small - 14.5%, medium-sized - 9.1%). Considering that in 1998 an average Bulgarian enterprise employed 8 people, it can be inferred that SME own considerable potential for additional employment if the conditions for the development of their business are favourable, and can help to reduce the comparatively high unemployment rate at regional and national level.

The SME share in 1998 imports is 38.52% (micro enterprises - 15.13%, small - 17.7%, medium-sized - 5.69%), and in exports - 22.12% (micro enterprises - 9.53%, small - 7.85%, medium-sized - 4.74%).[4]

---

[1] Report on SME for 1996 -1999 - Bulgaria, SME Agency - FED, CED, 2000.
[2] 1999 Annual Report of the SME Agency.
[3] SMEs in the Republic of Bulgaria in 1998, National Statistical Institute, 1999.
[4] Report on SME for 1996 -1999 - Bulgaria, SME Agency - FED, CED, 2000.

Analysis of the National Statistical Institute information for 1998 by economic sectors and industry groups shows that SMEs in the technology sectors comprise 98.8% of all enterprises in those sectors (see Appendix 5, Table 43). The SME total for the industry branch is 95.4%, and the highest relative share of 96.8% belongs to production of medical equipment, precision apparatuses and instruments, where obviously the highest diversification in the size of enterprises has been achieved, while the lowest - 89.9% - belongs to production of cars, trailers, semi-trailers, spare parts and accessories for them. The highest is the share of micro-enterprises in production of transportation vehicles, excluding cars - 90.3%, of small and medium-sized enterprises in production of cars, trailers, semi-trailers, spare parts and accessories for them - respectively 24.6% and 5.1%. The SMEs total 99.7% in services, featuring the highest relative share in businesses providing designs and programs and related services - 99.9%, and lowest - in scientific research - 93.1%.

The share of technology sector related SMEs in employment totals 44%, in the "Industry" branch - 36%, in the "Services" branch - 66.3% (see Appendix 4, Table 44) The share of technology sector related SMEs in turnover is on the average 46.2%, in the "Industry" branch - 18.6%, while in production of office and electronic and computing technical equipment it reaches 59.2%, in the "Services" branch - 69.6%, and in businesses providing designs and programs and related services - 86.2% (see Appendix 5, Table 45). The average turnover per employee (as a measure of clear labour productivity) at 100 average index per each branch group (see, Appendix 5, Table 46), in the "Industry" branch is the highest for micro-enterprises and medium-sized enterprises in production of office and electronic and computing technical equipment - 424 and 257 respectively (where the greatest deviation of 168.4% can be observed), in small enterprises for production of cars, trailers, semi-trailers, spare parts and accessories for them - 206. Generally, average turnover per employee at big enterprises, in most technology sectors in the branch is below 100, being the lowest in production of office and electronic and computing technical equipment - 53. That proves the relatively high efficiency achieved by SME following that indicator. Services feature the highest average turnover per employee in medium-sized enterprises providing designs and programs and related services -253, but generally it is 100 or slightly over for the big enterprises in the sectors of the branch. (see Appendix 4,Table 47)

The analysis of the data for operational profitability (expressed as a ratio between /operational revenues – operational expenses/ : sales revenues x 100) of technological SMEs in 1998 (see Appendix 5, Table 48Table 47) shows that for the "Industry" branch it is the highest - 8.6%- in micro-enterprises (and in the production of electric machinery and apparatuses it reaches 14.9%), 2.9% for small enterprises (production of medical equipment, precision apparatuses and instruments - 8.6%), 2.85 for medium-sized enterprises (production of cars, trailers, semi-trailers, spare parts and accessories for them - 7.8%) and 4.9% for big enterprises (production of transportation vehicles, excluding cars - 10.5%). Operational profitability is the lowest in medium-sized enterprises for production of transportation vehicles, excluding cars - -39.5%. The services feature operational profitability of 4.3% in micro-enterprises, 2.2% in small enterprises, and 1.2% in medium-sized enterprises, while in big enterprises it is 5.7%. If only SMEs are considered by sector in the industry, the lowest operational profitability is shown by micro-enterprises for scientific research - - 16.4% (where only big enterprises show positive operational profitability of 6.1%), and the highest belongs to micro- enterprises providing designs and programs and related services - 10.7%.

Factors for Technology Development

Policy and Legislation in High Technologies *(with emphasis on the information technologies)*

Assoc. Prof. Nely Ognyanova, director, Bulgarian Institute for Legal Development

Political acts of the Republic of Bulgaria with reference to the legislation of the Information Society (IS): strategies, programmes, concepts, sector policies

The need for political acts

The national information policy of each state determines the foundations of information order. In the conditions of transition to information society, the development of legal regulations as regards the basic information activities calls for the preliminary determining of:

- the scope of state intervention;
- the role of the other participants in the transition to IS;
- the major values and principles to serve as guidelines in the transition to IS;
- the organisation, the policy implementation and the control methods for IS problems;
- feedback vehicles, methods and mechanisms for assessing the effectiveness of intervention.

The formulation of the information policy is not related to a retrospection to the organisation principles of *closed societies* nor does it imply total state control over all areas of social life. The information policy, expressed in such acts as *strategies* and *programmes*, is necessary as a public form of political choice of the major principles *and* priorities of society in the respective area, so that this foundation is made a consistent use of to the end of developing a uniform legislative framework. It was only the 38th National Assembly and the government currently in power that introduced this three-stage approach to the information sector (political framework – legal framework – regulatory framework), where, in compliance with community legislation, the executive power had a clear-cut separation of its governing and regulatory functions and the economic activity for the respective area was transferred outside state structures (for example the Bulgarian Telecommunications Company (BTC), the Bulgarian Postal Services, etc.).

The political acts, which, in their unity, define the scope and the stages of development of information society law, are as follows:

- The National Programme and Strategy for Information Society Development;
- The *Bulgaria 2001* Agenda of the Council of Ministers for the years 1997-2001.
- The National Programme for the Adoption of EU Law Achievements;
- The Strategy for Developing a Modern Administrative System in the Republic of Bulgaria;
- The National Strategy for Encouraging the Development of Small and Medium-size Businesses;
- The Uniform National Strategy for Crime Prevention;
- The National Strategy for the Development of High Technologies
- The National Electronic Trade Programme;
- The National Education Strategy for Information and Communication Technologies
- Telecommunications Sector Policy

The National Information Society Development Programme introduces the following two priorities as regards IS law:

- adoption of European standards ensuring access to information, provided that the security of the data and the fundamental human rights are guaranteed; and
- creation of a transparent and foreseeable legal and regulatory framework for providing the services of the information society.

Electronic Trade was defined as a national priority relatively early, by Decision No. 86 of 1 December 1997, whereby the Council of Ministers also provided for the adoption of a National Electronic Trade Strategy.

The Strategy for Developing a Modern Administrative System (adopted through Decision No. 36 of 9 February 1998) provides for the adoption of specific legislative acts such as:

- The Public Information Access Law;
- The Normative Acts Law;
- The Public Orders Law.

According to the Programme, and in compliance with community law and the specifics of national information relations, **the regulation spheres prioritised for the year 2000** are:

- access to information;
- security of personal data;
- protection of intellectual property under the new conditions;
- regulation of the new forms of crime and fighting them;
- regulation of high-tech activities and high-tech parks;
- regulation of electronic documents and electronic signatures.

As the National Strategy proper provides for updating, **the 2001 priorities** are expected to address the need for observing the *new package of legal regulation proposals (five directives and one decision) on community electronic communications* as they were set forth by the 2293rd Session of the Council of Ministers of EU Member-States in October 2000 in Luxembourg:

The National Strategy for High-tech Activities Development specifies the priorities and introduces, in particular, the obligation to ensure:

- equal legal status of domestic and foreign persons;
- promotion of foreign investments;
- effective protection of intellectual property items;
- legal regulations on the investments of risk capital;
- regulated labour conditions and social security provisions for the persons employed in high-tech companies;
- non-restrictive tax legislation;
- drafting of bilateral double tax treaties

Legislation

High-tech Activities

The High-tech Activities and High-tech Parks Act (Draft)

The legislative regulation of high-tech activities will be accomplished by the High-tech Activities and High-tech Parks Act (HAHPA) which has been under preparation since the beginning of 1999. For the time being, the Draft is undergoing a second reading before the Parliamentary Economic Commission.

The Draft aims at creating favourable legislative, economic and institutional conditions for the development of high-tech activities and high-tech parks in the Republic of Bulgaria.

The Scope of the Draft can be described in terms of two basic criteria:

In terms of entities: initially, the Draft was meant to create favourable conditions for carrying out high-tech activities by economic entities that establish high-tech parks or entities operating within the territory of high-tech parks. Subsequently, however, under the pressure exerted by the operating commercial companies, and especially those in the information technologies sector, the favourable conditions were extended also to the entities pursuing high-tech activities outside the high-tech parks.

In terms of activities. Defining high-tech activities presented special difficulties. After an extensive comparative analysis of other states' practices where similar legislation is in force, it was found that states define their specific priorities and govern them through a particular regulatory regime, which is more favourable than the generally applicable terms. Therefore, it was suggested that the Council of Ministers, with the support of a High-tech Development Council formed on a broad public basis, would adopt a National Strategy for High-tech Activities Development and Annual Programmes for High-tech Activities Development whereby the priorities would be updated.

The Draft introduces **the following criteria** to define high-tech activities:

- High-tech activities are related to innovations (the transformation of an idea or a project into a new or enhanced product or into a new or enhanced production method for goods and services) scientific, research, development, technological, construction design, innovative and engineering activities, education and training, technologies and know-how transfer related to the creation, production and application of high-tech products.
- High-tech activities and products are defined in conformity with the Standard International Trade Classification (SITC), the European Organisation for Co-operation and Development, the effective EU Framework Programme on Scientific Research, Technological Development and Innovations and the National Industry and Product Classification of the National Statistical Institute.

High-tech activities are being developed with priority in the following areas:

- information technologies, computer systems and software provision;
- telecommunications and communications equipment;
- microelectronics, micro-mechanics and micro-systems;
- new materials, chemical substances and components;
- electrical engineering, power equipment and systems, energy efficiency, renewable and alternative power sources;
- automation and robotics systems and means;
- electronics, device construction, medical equipment and scientific research appliances;
- biotechnology, pharmaceutics;
- new plant sorts, animal breeds, genetic engineering;
- medicine and improvement of the quality of life;
- environmental protection and sustainable development;
- space research and aerodynamics;
- management technologies.

The Act regulates the legal status of **high-tech parks** as entities acting under the provisions of the Trade Act, which are subject to register entry under certain conditions:

- over 8000 sq. m territory and/or buildings with a total built-up area of over 2500 sq. m and with accomplished infrastructure (energy, water, piping and sanitation, communications), or secured project financing in the part of building(s) and overall infrastructure construction;
- at least one legal entity from the academic community (higher education establishments and the Bulgarian Academy of Sciences) should participate as founder;
- at least 2/3 of the persons working in the high-tech park territory should be legal entities from the academic community (higher education establishments and the Bulgarian Academy of Sciences) and/or persons performing high-tech activities;
- a fund should necessarily be set-up for risk innovative projects;
- consulting and accounting services should necessarily be provided to the users of the incubator part of the park, etc.

The Act also regulates the **status of** the entities performing high-tech activities within the territory of the high-tech park:

- at least 35% of the employees must have university education and at least 10% must be students or specialists below 35 years of age.
- the proceeds from high-tech products sales must be higher than 75% of all incomes generated from the activity;
- the total expenses for scientific, R&D activities, software products, patents, licenses, know-how and technological transfer must be at least 6% of the company's total expenses, etc.

The Draft also provides, through revisions and amendments of the effective tax legislation, for the establishment of **favourable conditions** for high-tech activities.

The high-tech parks and the entities performing high-tech activities registered under this Act shall be entitled to a choice of tax liability between either profit and municipal taxes or a final tax to the amount of 1.5 per cent of the incomes generated from the activity, 50 per cent of which shall be transferred to the municipalities where the high-tech park or the person performing high-tech activities is established. The high-tech parks shall be entitled to a registration as free zones under the provisions of Decree 2242 on the Free Zones. Unfortunately, the exemptions list is quite limited and no treatment is provided for the tax and security status of the specialists within the high-tech parks.

Administration. Provision is made for the establishment at the Office of the Minister of Economy of a High-tech Development Council consisting of 20 members, at the proposal of executive bodies, professional associations, high-tech parks, the Bulgarian Academy of Sciences, higher education establishments, etc. In parallel with the Minster of Economy, the Council will play an essential role in defining the priorities of high-tech activities, in registration and control over the activity, and in entities removal from the high-tech parks register.

Future Prospects and Problems. The Draft will be read before a **two-trend** split Parliament: one trend is represented by the supporters of existing scientific organisations, including the Bulgarian Academy of Sciences, who will try to preserve the tradition and limit the participation opportunities of such structures to the newly formed high-tech parks; the second trend consists of more radically-minded MPs, who are aware that any delays in the transition to the information society will affect not only a particular sector (such as the information industries or the communications), but the entire social organism, the economic growth and the living standard of people. The question is not only about the new job opportunities directly related to information technologies (2.7 million for the US), even if the indirect employment effects are not accounted for, nor is it about the degree of information or education of citizens. The question is about the status of the future generations of Bulgarians. Therefore, it is vital that the government's declared will to promote high-tech activities is effectively conducted to Parliament.

Besides, **there is readiness for the establishment of high-tech parks** and some commercial companies and scientific organisations are just waiting for the adoption of the law in order to proceed. Moreover, certain entities are actually operating applying the philosophy of the Draft and undertaking positive

organisational steps such as membership in international high-tech parks associations. This fact is only an evidence that the government is a bit slow in the legislative settling of actual economic processes.

One of the possible problems, upon the adoption of the Draft text, will be the formation of **a balanced and effectively working** Technological Development **Council** at the Office of the Minister of Economy, which will be the actual administrative authority for implementing the law.

E-Economy

The Electronic Document and Electronic Signature Act (Draft)

The Demand. Electronic economy is a reality, regardless of whether legislators have assumed any position to its existence or not. The vitality of the entire economy and of each economic entity is already dependant upon their readiness to transfer their basic sub-systems into the network. The EU laid the foundations of the new community legislation in this area by the adoption of Directive 1999/93/EU regarding the legal framework of electronic signatures and in the spirit of Directive 2000/31/EU on electronic trade, which was adopted later in the year. In conformity with the National Strategy and the Programme on the Transfer to the Information Society 1999-2000, the Electronic Document and Electronic Signature Draft was drawn with the participation of the non-governmental sector. The major aim of the Draft is to equalise the effect of electronic documents to that of written documents, thus opening the way for settling transactions in the network and for the development of the electronic economy with the range of all its applications: from the banking sector to the electronic Notary Public Office. In parallel with this, the broad application of electronic signatures is related to guaranteeing confidentiality, personal privacy and security as the basic principles of electronic communications.

Scope. The Draft settles the issue of electronic documents and electronic signatures as well as the order of providing certification services. It embodies the principle that the written form needs to be adopted where an electronic document is created.

Definitions are provided for the *terms*: "electronic statement" as "verbal statement, represented in digital form pursuant to a uniform standard for transformation, reading and visual representation of information" and of "electronic document" as an "electronic statement recorded on a magnet, optic or other carrier allowing for its reproduction". The term "electronic signature" is given a technologically neutral definition as "any information related to the electronic statements in a way agreed between the author and the addressee and secure enough in view of circulation needs, which (a) proves the identity of the author of the electronic statement (b) shows the agreement of the author with the electronic statement, (c) protects the contents of the electronic statement from future alterations." The difference between "electronic signature" and "enhanced electronic signature" is related to the opportunity of including additional information in the electronic signature, whereby the "enhanced electronic signature" is a transformed electronic statement, included, added or logically connected to the same electronic statement before the transformation. Also, definitions are provided of the transformation principles based on the use of private keys in an asymmetric encryption system.

Status of Certification Service Providers. According to the Draft, the provider is a person issuing electronic signature certificates and maintaining public electronic registers for them, who provides the electronic signature holders with the opportunity to create public and private keys and gives any third party access to the registered certificates. In the meantime, the relations between the certification services provider and the holder of the electronic signature need to be based on an agreement in writing.

Certification. The Draft provides a description of the various parts of the certificate proper as an electronic document issued and signed by the certification service provider, and regulates the issuance, the renewal an the termination of the certificate's effect. Also, the general provisions are formulated as regards the public registers of issued certificates. Their activity and structure is subject to regulation by the Council of Ministers act. The regulation and the control over the activity of providing certification services is entrusted to the State Telecommunications Commission.

Chapter Four regulates the "universal electronic signature" which is the only signature meant for use in the public sector. The maximum security requirements predetermine the introduction of a *registration regime* for the certification service providers. This is in conformity with Article 3, Paragraph 7 of the European Parliament Directive and the Council on the Community Framework on Electronic Signatures. The Council of Ministers may, at its own discretion, appoint the state bodies, which may exchange their correspondence under different electronic signatures. The State Telecommunications Commission, as an institution regulating and controlling the activity of certification service providers, would have to register providers offering services relevant to the enhanced electronic signature, which is applicable to the public sector. The suggested regime is one of registration and not of licensing. The registration procedure needs to be regulated by a Council of Ministers' act. The rights of the registering institution have also been defined.

The registered certification service provider may certify the date and the hour of the submission of an electronic document which is electronically signed.

The Draft also settles the general terms for applying electronic documents and electronic signatures within the state and the municipalities, which will be attained through the establishment of the necessary conditions and infrastructure and the effecting of the legislation necessary in this respect.

It also envisages the protection of personal data gathered by the certification service providers for the purpose of their activities and for the maintenance of registers, as well as the personal data disclosed to the State Telecommunications Commission (STC). Such logic predetermines that the collection of personal data on the author and the holder, and the use of such data, is limited only to the issuance and the use of certificates. Exceptions to the rule are made possible only in the case of express legislative provisions or with the express permission of the person whose data it concerns.

Chapter Seven regulates the requirements which need to be fulfilled so that the status of the certificates issued by foreign providers would be accepted as equal to that of the certificates issued by Bulgarian providers. The control over the special requirements will be exercised by the STC, which will maintain the public electronic register containing the necessary data. These provisions will not apply where the certificate of the certification service provider issuing the certificate are being identified under an effective international treaty.

Administration. The implementation of the law will be carried out by the State Telecommunications Commission. In this manner, in parallel with all its other functions as an independent regulator in the area of telecommunications, the STC will expand its functions as an administrative authority in the area of high technologies. Provision is made also for a registration regime of the certification service providers, which will provide enhanced electronic signatures applicable in the public domain.

Future Prospects and Problems. **Subsidiary legislative acts** will be drawn in order to settle some important, but specific, issues of a technological or purely legal relevance such as:

- ordinance on the requirements for the enhanced electronic signature algorithms;
- ordinance on the available funds maintained by the certification service providers;
- ordinance on the insurance of certification service providers against the damages of non-performing their obligations under the law;
- ordinance on the technical and technological equipment held by the certification service providers;
- ordinance on the structure and the activity of the public electronic registers maintained by the certification service providers;
- ordinance settling the activity of certification service providers and the order for the termination of such activity;
- ordinance on the format requirements for the certificates issued by the certification service providers;
- ordinance on the storing requirements for the information on the services provided by the certification service providers;

- ordinance on the requirements for the content, the format and the sources as regards the information disclosed by the certification service providers;
- ordinance on the requirements to the persons performing inspections on the observance of the requirements under Articles 17 and 21 by the certification service providers;
- ordinance on the registration of the certification service providers;
- ordinance on the termination of the activity of the registered certification service providers;
- registration tariff for the certification service providers;

It will be appropriate to reduce the number of the ordinances to one or two (for example, ordinances of technological and legal-organisational character). Further settling is envisaged for a number of other issues such as the taxation of the transactions within the network. **The major problems** expected in the implementation of the legal regulations are related to:

- the lack of qualified specialists in the administration; the need for preparation in order to introduce the universal electronic signature into the activities of the state and the municipalities;
- the inadequate preparation of the possible certification service providers as regards the issues of the legislative framework;
- compatibility with a possible parallel certification system, such as the banking sector, for instance, etc.

Intellectual Property Protection in the Information Society.

Amendments to the Copyright and Its Related Rights Act and the Penal Code, Ordinances Against Piracy

The Demand. Community legislation is a response to the need for a new legal framework covering the entire range of issues of intellectual property within the information society. On 21 January 1997 the European Commission set the beginning of the debating and adoption process of a new **Directive of the European Parliament and the Council on the Harmonisation of Some Aspects of Copyright and its Related Rights within the Information Society**. On 28 September 2000 the Common Position 48/2000 of the Council was published, and the adoption of the Directive is forthcoming. It consolidates the currently existing regulations, repeals some of the provisions and renders community law in conformity with the legislation of the World Intellectual Property Organisation (WIPO) as regards copyright and its related rights, WIPO Copyright Treaty (WCT), treating *inter alia* the rights over software products (Article 5) and databases (Article 6) and the WIPO Performances and Phonograms Treaty (WPPT).

The development of the high-tech sector is closely interrelated with the task of providing a most effective protection of intellectual property as the major product of high-tech activities. Foreign investors in high-tech activities are known to perform serious researches of national legislation and their effectiveness. At home we have an effective copyright protection regime at a European level. Recently the **Copyright and its Related Rights Act** (CRRA) underwent several revisions in response to the advance of new technologies and their impact on the protected items. Various high-tech activity copyright products are being protected such as products stored on magnet or optic carriers. Also, various categories of persons are being protected, both authors and performers, as well as radio- and television organisations. As it is known, Decree No. 87 of the Council of Ministers of 16 April 1996 on the Control over the Usage of Copyrighted Products introduces a licensing regime for CD manufacturers and CD matrices in view of the effective control and protection of intellectual property. The most recent amendments account for the adoption of several international treaties in the area of intellectual property such as the GATT/TRIPS Agreement of 1994 (an agreement on the commercial aspects of intellectual property) signed under the aegis of the World Trade Organisation, which has also been ratified by our country, as well as the WIPO treaties respectively in the areas of copyright and its related rights of 1996. Some of the provisions of the directives were adopted into our domestic legislative acts as early as the time of their drafting in 1993 since the tendencies were already clearly outlined. For instance, the right for satellite and cable broadcasting of copyright products was introduced.

In view of Bulgaria's endeavours to occupy a leading position in the area of information structures, the country demonstrates a special interest in **the system of measures against software pirating.**

Scope of the Measures. Regardless of the responsibility provided for by two legislative acts, the Penal Code and the CRRA, piracy (the illegal use of software) is 90% in 1998, with the rate dropping to 80% in 1999 (according to data from the BSA Bulgaria).

Software products are under the protection of the **CRRA** and, upon violations of the rights of the author or those of the secondary rights holder, legal administrative and civil responsibilities are envisaged.

The Penal Code was also amended and the amendments providing for penal responsibilities were effected as of 1 January 2000. Upon reports submitted to the police, a check-up can be carried out at the site. Where any unlicensed software is found the computers and the carriers are subject to confiscation. For the year 2000 45 check-ups were performed by the National Office for Fighting Organised Crime, which were directed mainly at two groups of persons: consumers using the software in their business and companies selling computers with unlicensed software installations. The first court decisions are expected to enter into force by the end of the year.

In view of improving the copyright protection of software, two ordinances have been drawn, which are currently under debate.

The first ordinance contains **border control measures**. In December 1999 the amendments of the Trade Marks and Patents Act entered into force, whereas in May 2000 amendments were made to the CRRA, which reflect the requirements of the TRIPS Agreement whereby the member-states of the World Trade Organisation are obliged to introduce border control measures on copyright. The new ordinance provides for two opportunities to hold the products on the border:

- upon the request of the trade mark or software rights holder;
- by the ex officio decision of the customs.

The second ordinance is on **the** management and control over the use of software by state authorities and their administration. The scope of the ordinance covers both computer software and computer databases. There is also a provision that the users use these in compliance with copyright legislation, the licensing agreements and the administrative regulations, whereby they may not:

- install and use software products without holding the necessary license;
- reproduce the software products in one or more copies in whatever manner and form except for a back-up copy;
- disseminate the software products;
- modify or introduce changes in the software products or their programming code;
- offer wireless or cable access or access by any other technical means to the software products from a location and in time individually chosen by third parties;
- use personal software products on the official computer systems;

In order not to restrict the user excessively, where, for concerns of encryption or other legitimate reasons the user may need access to the programming code, the restrictions herein above will not apply to the software where the license agreements expressly allow for reproduction, dissemination, changes, modifications or any other way of use in compliance with the CRRA. Special obligations are established for the head of the "Information Provision" department within the respective administrations whereby:

- they shall be responsible for the initiation and the maintenance of a register of the obtained software licenses and the respective computer systems with installed software and the accompanying documentation;
- they shall organise and manage regular stock control of the computer systems in stock and the software installed on them;

- exercise current control over the acquisition, installation and use of software products within the respective administration as well as inspect for the compatibility of the software to be installed with the industrial standards the operational systems and applications installed and with the operating technical devices;
- where the software is acquired with the computer systems, they shall observe the compliance with the regulations concerning such manner of distribution;
- where any violations are found, they shall immediately take measures for the legitimate obtaining of the respective rights or uninstall the respective software.
- Some elements of copyright software protection can be traced in the Convention on Cyber-Crime which is under preparation by the Council of Europe. Through its representatives in the working structures of the Council of Europe Bulgaria is following closely the debate on the Draft Convention as its provisions tend to balance two conflicting interests:
- the protection of the secrecy of electronic communications; and
- the joining of the efforts on the super-national and transborder plane for fighting the new categories of network crime or conventional crime (terrorism, etc.) carried out by the means of the network, including the breach of communications secrecy, the personal privacy of the participants, etc.

The Draft Convention (Article 10) stipulates that:

- Each state-party to the Convention shall adopt such legislation or other measures as may be necessary to proclaim as crimes under its domestic law the breach of *copyright*, as it is defined under the law of this state and in compliance with the obligations undertaken by the state under the Paris Treaty of 24 July 1971 as regards the Berne Convention on the Protection of Literary and Artistic Works, the GATT/TRIPS Agreement and the WIPO Copyright Treaty, with the exception of any personal rights, settled by this Convention, where such actions are performed intentionally within commercial dimensions and via the means of a computer system.
- Each state-party to the Convention shall adopt such legislation or other measures as may be necessary to proclaim as crimes under its domestic law the breach of *the related rights*, as they are defined under the law of this state and in compliance with the obligations undertaken by the state under the International Convention for the Protection of the Artist Performers, the Sound Record Producers and the Broadcasting Organisations adopted in Rome (the Rome Convention), the GATT/TRIPS Agreement, and the WIPO Treaty on Performance and Sound Recording, with the exception of any personal rights, settled by this Convention, where such actions are performed intentionally within commercial dimensions and via the means of a computer system.

Administration. There is a problem with the identification of all structures and institutions which need to be involved in the protection of intellectual property. In the first place, this responsibility lies with the Copyright Directorate at the Ministry of Culture. For the purpose of measure co-ordination, an interdepartmental Copyright Council was established at the Council of Ministers. Various legislative acts confer powers to the National Radio and Television Council, the Ministry of the Interior, the Ministry of Finance, etc. For the time being, the effectiveness of law enforcement is not really high although several campaigns had proved effective (for instance, the closing down of unlicensed CD production lines, whereby the illegal production dropped from 45 million to 1 million, which is about the estimate of domestic consumption). The rights holders associations are also operating successfully. They even managed to have their (controlling) powers legitimised through the latest amendments to the CRRA.

Future Prospects and Problems. Regardless of the success Bulgaria had in fighting piracy (the production of optic carriers, retransmission of TV programmes by cable operators, etc.) which lead to the removal of the state from the black list of the Us Department of Trade, within the dynamics of the IS the sector is constantly expanding the range of the potential items needing protection, as well as the range of possible violations. One cannot expect an effective transition to information society, where there is no provision for: (1) adequate furthering of the development of the legal framework for the protection of intellectual property, especially as regards software and databases and in compliance with the developing legal standards of the European Union, the Council of Europe and the World Intellectual Property Organisation; and (2) effective implementation of the legislation, including through (3) interaction with

the non-governmental sector (organisations such as Bulact, Business Software Alliance, etc.) NGOs for fighting against piracy and associations of legal rights holders acting in co-ordination with the economic police.

Telecommunications Electronic Media, Convergence

Legislative Regulations and Administration

The Telecommunications Act (1998) settles the full range of telecommunications issues. It was drawn after multiple expertise consultations for compliance with community legislation and introduces the principles of the EU Directives in the area of telecommunications. The monopoly of the state (for the areas where it still exists) will be terminated by the end of 2002. The Act, as well as the Radio and Television Act (1998) does not contain any investment restrictions from the perspective of nationality. There is a process of an overall liberalisation of the telecommunications and the electronic media sectors. The *regulatory body* – the State Telecommunications Commission – was separated from state administration (the Ministry of Transport and Telecommunications). The major principle of the regulating activity is the transparency in applying the law, especially in the course of licensing procedures, an in view of the criticism on the lack of transparency as regards certain decisions. There is a forthcoming expansion of the powers of the regulatory body in view of setting-up a regulatory framework of electronic trade.

The Radio and Television Act (1998), after its amendments in 2000, is assessed as being fully harmonised with the consolidated Directive *Television Unlimited. The National Television and Radio Council* acts as an independent regulatory body as regards the contents of electronic media programmes. In the conditions of convergence, the activity of the two regulators must be reassessed from the perspective of applying a coherent approach in the regulation of the programme and the telecommunications aspect of electronic media (the regulators in Great Britain, for instance, have set 2005 as the deadline for the reassessment of the powers held by each of them).

The Internet is under no special regulation, and was deregulated as of 1 January 1999. The responsibility of the providers is based on the general principles of civil legislation. The Internet contents is settled only on the basis of the Constitution and the general restrictions of the Penal Code.

Administration of the Internet. The management of the Internet is different from that of the familiar super-national regulation activities. With the increase in its importance, the administration of the network suddenly became a key issue for governments and, on the other hand, for all categories of persons participating in the exchange. On the EU level, the latest response in this respect is the Council Resolution of 3 October 2000 on the organisation and the management of the Internet. The objective is to attain *an internationally recognised and transparent system for the management of the domains name system* covering *the European representation to a satisfactory degree*, especially when taking into account the forthcoming development of electronic trade, and, subsequently, the increase in the economic interests which will depend on the administration of the Internet resources. Intensive work is being done, both in the European Commission and the member-states, for the active involvement of Internet professionals and professionals from the European private sector in the establishment of a special institution for network administration (Internet Corporation for Assigned Names and Numbers ICANN) and for determining its governing bodies. The same issues are also addressed by WIPO and the ITU. An effective mechanism is being sought for solving the domain names disputes (especially with the generic Top Level Domain Names (g TLDs)).

The respective act points out to the following unsolved problems:

- the nature of and an agreement on a balanced an equal monitoring by public bodies over some of the actions of ICANN;
- the rules for the management of generic domains, and especially the ownership over databases and the division of registers and the register activities;
- delegation of the TLD to another manager upon the request of the interested Government;

- the interrelations between the established registers within the Community and their public bodies on the one hand, and ICANN on the other;
- the transfer and the management of the root server system from the US Department of Trade to the ICANN with adequate international monitoring by public bodies;
- the recognition of rights over domain names, their correspondence with trade marks, the termination of names preserving practices for the purpose of trade, etc.

In view of solving these problems, the European Commission is assigned to further the analyses and the co-ordination with the purpose of involving "the scientific, the technical and the legal expertise available in the member-states for the time being as regards the management of domain names, addresses and Internet Protocols". The Council has assigned the Commission with the drafting of a proposal for a Decision as regards the setting-up of an EU top level domain as soon as possible and not later than November 2000, as a sign of the European identification of Internet service and information providers, designed to address the needs of electronic trade, education, the public services, the libraries, the scientific and cultural institutions and to serve the interests of the end users.

Convergence. Under this item only one boundary issue will be treated which is related to the legal regulation of the telecommunications and the new media and is being broadly discussed, including within the framework of the legal Euro-integration of Bulgaria. This is the contents of the network. By an act of the European Parliament, the Council, the Economic and Social Council and the Committee of Regions **COM(96) 487 on the illegal and harmful contents of the Internet** the EU defines the two concepts, whereas by an act **COM(96) 483 The Green Book on the Protection of Juveniles and Human Dignity in Audio-Vision and Information Services** the respective measures are being provided for. These issues are declared as priorities in the work of the European Commission. Balance needs to be attained between guaranteeing the free movement of information on the one hand and the protection of public interest on the other. For the time being, these issues are being covered by the existing regulations regarding:

- The national security: drugs trafficking, terrorism;
- Minority protection: the prohibition of racial or any other discrimination;
- Protection of human dignity: prohibition of violence, pornography, defamation, etc.;
- Economic and financial security: the prohibition of credit card abuse, of unfair competition, etc.;
- Protection of intellectual property: fight against pirating;
- Personal privacy: prohibition of unauthorised access to personal data;
- Information security: penal measures against computerised crime;
- The principles adopted at the Regulators' Summit in the area of new media (Paris, December, 1999) are as follows:
- information which is immoral and contradicts the law online is necessarily immoral offline, and, therefore its diffusion must be restricted regardless of the type of the media.

Each media is neutral by notion to morals and law. It can be used for purposes, however, which are either compliant or contradictory to morals and law. In such manner, for example, the Internet is being used by terrorists, but is also used for special actions, humanitarian aid, etc.

The Internet is a global network which incorporates people belonging to different cultures. Within these cultures there are different regulatory systems, which cannot subsequently prevent the Internet from remaining open outside the jurisdiction of any one or another country.

The most acceptable regime is that of co-regulation: the combination of legal instruments of the state with rules established and applied by the participants proper in the communications and their non-governmental organisations.

Means will have to be developed in view of preventing the illegitimate use of the web or its inflicting harm on children, the youth and other categories of users. By type these means can be as follows:

- Technical;
- Software;
- Organisational;
- Legal.

Education and Technological Development in Bulgaria

Assoc. Prof. Milanka Slavova, University of National and World Economy

Education is both one of the factors for the development of high technologies in the country and an important area for their specific implementation. Modern society asserts itself as the society of knowledge and continuous education necessitated by the need for fast adaptation to the changing realities.

The influence of education on the development of high technologies is outlined herein, mainly based on the quantitative indices of the number the students in the various degrees[7], the condition of the training and technical facilities of schools and the financing of education. The major statistical data on the education in Bulgaria is being collected and processed by the National Statistical Institute on the basis of the International Standard Classification of Education, rev. 1997, presenting information based on educational degrees.

Strengths of the Educational System Regarding High Technologies

Bulgaria sustains a good educational tradition in the area of high technologies. The country has set-up a system of secondary vocational and profile schools offering training in the area of computer and technical sciences. In the 1998/1999 school year the number of the technical, vocational and arts schools was 349 with a total of 13 893 teachers and 127 247 students.

Also, there is a significant number of students in the secondary schools, which acquire qualification in the area of engineering and technologies. The average number of students per year is about 50,000 (48,453 students for the 1998/1999 school year), whereas the annual average number of graduates is about 10,000 (10,662 for 1998/1999). Of the total number of the average annual graduates coming from secondary technical, vocational and arts schools about 38% specialise in technical profiles. In the years from 1996 through 1999, the number of the students graduating from technical and professional schools grew from 9,499 to 11,024.

According to data from the National Statistical Institute, an average of 200 specialists in computer science graduate from school each year (182 in 1996, 243 in 1997, 229 in 1998 and 217 in 1999).

Also, there is a tendency of growth in the number of computer science graduates: from 763 in the 1994/1995 school year, 869 in the 1995/1996 school year to 1,143 in the 1998/1999 school year. The annual average of graduates in the area of production technologies is about 22,000.

Universities. There are a number of universities in the country offering training in the area of information technologies and their application:

- Technical universities: Sofia, Varna, Rousse, Gabrovo;
- Economics Universities: The University of National and World Economy, the Varna University of Economics;

[7] The data quoted hereinafter referring to the number of the schools, students according to specialisation profile, university students and doctorate courses students are based on the 1999 Statistical Annals of the National Statistical Institute, Sofia.

- The American University in Blagoevgrad;
- The New Bulgarian University;
- In the area of high technology theoretical studies: the St. Kliment Ohridski University of Sofia, the P. Hilendarski University of Plovdiv and the universities succeeding the former higher education institutes specialising in chemistry, technologies, food and beverage industries, etc.

The number of the students enrolled for the 1998/1999 academic year in the baccalaureate, master's and doctorate courses is respectively 46,196 in the majors of engineering and technologies, 6,618 in natural sciences and 5,247 in mathematical sciences. An average of 4,000 students per year graduate from the baccalaureate and the master's courses in engineering and technologies and another 1,000 graduate in natural and mathematical sciences.

There is a positive tendency of growth in the number of doctorate courses students in these three majors. The 1998/1999 academic year saw a peak in the number of students enrolling in the doctor's engineering and technologies course: 605 of a total of 2,775; natural sciences ranked second with a total of 496 doctorate courses students. Also, there is a significant number of scientific workers in the area of technical and natural sciences. As of 31.12.1999 there were 6,001 scientific workers employed in the area of technical sciences and 4,868 in the area of natural sciences. However, their numbers are decreasing in stable rates.

An indirect prerequisite for the development of high technologies education is the expansion of the foreign language programmes, whereupon an opportunity is created to easily access the global achievements in each area.

Weaknesses of the Educational System Regarding High Technologies

Information technologies and the other areas of high technologies education suffer from the poor availability of training facilities. According to a research of the National Institute of Education in 1997, 23.83 students availed of 1 operating 8-bit computer, whereas the number of students per 1 16-bit operating computer was 69.64. For some parts of the country these figures are even more unfavourable. Table 4 shows more recent data on the distribution of computers in the various types of schools.

Table 4 Number of computers in the schools[8]

Type of school	8-bit	286	386	486	Pentium	Printers	Other	Total
Secondary Schools	217	48	21	12	35	37	58	428
Elementary Schools	84	8	5	11	10	27	5	150
Primary Schools	2040	280	66	47	47	535	195	3210
Arts Schools	0	1	0	1	0	3	0	5
Junior High Schools	22	0	0	7	2	8	0	39
Profile Schools	540	233	197	220	155	304	342	1991
Professional Technical Schools	0	0	0	0	0	0	0	0
Secondary General Education Schools	4613	615	322	270	157	1123	500	7600
Special Schools	255	44	23	5	2	85	9	433
Sports Schools	115	12	8	3	1	21	1	161
Secondary Professional Technical Schools	941	60	30	26	4	183	66	1310
Technical Schools	2638	549	428	345	450	921	526	5876
Total	11 465	1851	1191	947	863	3247	1612	21 186

Source: National Institute of Education[9]

[8] Plus, 1 December 2000.

The data in the table shows that only 10% of the schools have access to modern computer technologies. According to the data of the National Institute of Education, the available technical facilities allow for the equipment of about 250 computer science labs. About 68% of the schools have no computers at all. Also, a growing number of schools do not avail of chemistry and physics labs. The major problems of education, which have reference to high technologies are:

- The existence of secondary schools (mainly technical and professional technical schools) where the subject of computer science is not being taught at all;
- The poor integration of information technologies education into other school subjects and its poor influence over the contemporary methods and forms of education;
- The poor qualification of the information technologies teachers and the poor motivation of school and university teachers to educate themselves and use the information technologies in the process of education.
- The growing number of dropouts is also a worrisome fact. According to researchers, with a tendency like this, in 15 years Bulgaria will see a considerable drop in the number of specialists holding secondary and higher education certificates.
- The limited access of students to the solution of specific practical problems;
- The meagre financial means for the development of the education system: the 2001 State Budget allocates about 3.88% for secondary and university education and science. The figure has grown in comparison with the allocations for 2000 (3.22%), but is still considerably lower than the minimum allocation of 6% of GNP set out by the European Union;
- Most of the funds allocated for education are being spent on salaries: about 86%. In the more developed countries salaries constitute about half of all funds allotted to education;
- There is a lack of initiative on the behalf of employers to invest in the professional training and the improvement their employees' competence and skills;
- The professional qualification system is incomplete and is not related to the academic professions;
- Another unfavourable tendency is the ageing of the scientific potential of the country and the low social prestige of the education and science occupations. Some of the EU member-states (such as Great Britain, Denmark and Germany) are experiencing the same problems facing a drop in the number of specialists graduating from the engineering majors, physics and mathematics[10];
- The scientific and research teams outside universities and colleges are poorly integrated in the teaching process of the baccalaureate and master's courses in the various branches.

There is also an unfavourable and steady tendency of decrease in the number of scientific workers in the areas of technical and natural sciences. The early 90's saw the most drastic drop generated by the closing of the industries science and research organisations. A number of prominent technical science representatives (including people holding authorship certificates) had to change their profession or leave the country. According to the researches of the Bulgarian Academy of Sciences (BAS) most of the engineering and technical science professionals, who quit the institutes of BAS, went to business, whereas only a small part went to educational establishments or private research organisations. Also, there is a continuous tendency of decrease in the number of technical and natural science professionals during the second half of the decade. In 1996, there were 7,421 scientific workers in the field of technical sciences; in 1997 their number was 7,225; in 1998 they were 6,813 and in 1999 they reached 6,001.

---

[9] Plus, 1 December 2000
[10] Statistics in Focus, 1/2000, p.6

The number of scientific workers dealing with natural sciences exhibits much the same tendency: 5,101 in 1996, 5,054 in 1997, 5,069 in 1998 and 4,868 in 1999.

Opportunities for the Educational System as Regards High Technologies

State authorities recognise the importance of information society for contemporary development and of the initiation of measures for acquiring competence in the area of information technologies. This position is well substantiated in the *Education and Science* section of the Strategy for Building the Information Society (in the country) and by the setting-up of an Education and Science Working Group at the Co-ordination Council for Building the Information Society. A National Educational Strategy for Information and Communication Technologies was developed in combination with an Implementation Programme aimed at changing the approach in the study of information technologies. It stipulates for the obligatory incorporation of the subject of computer science in the school curricula as a part of the students' vocational training aiming to equip them with competence on how to use information technologies in their chosen profession.

The legislative system is also being updated in order to provide for the introduction of the information technologies (new rules for the professional capacity of computer science teachers; development of new educational programmes; granting of preferences for the purchasing of technical equipment for the educational system etc.)

The Programme provides for the re-equipment of schools and universities with new hardware and software and access to the Internet, setting a minimum of requirements to the equipment (on an annual basis), so as to prevent the purchasing of outdated stock. Within the period 2000-2004, it envisages for the purchasing of 78,000 computers, 7,800 printers and 3,710 modems. Here are some further measures, which can be introduced in the educational system:

- Development of educational software;
- Expansion of foreign language training with coverage of the early school years: one foreign language from the first grade onwards and a second one from the fifth grade onwards;
- Elaboration of a new list of professional occupations corresponding to labour market demands and including more attractive professions for the young;
- Development of new state requirements for getting university education[11];
- Implementation of international projects relevant to computer science education under the aegis of the Open Society Fund, the Educational Initiative of IBM for Bulgaria, the British Council programmes, satellite training programmes in the French language, etc.

The country maintains an up-to-date information database for participation in European educational programmes. For instance, the Leonardo da Vinci II Programme focuses on the priority of exploiting the potential of information and communication technologies. Also, it formulates measures for the improvement of professional linguistic competence. Since 1999 Bulgaria has become a member of the SOCRATES Programme. The second stage of the SOCRATES Programme covers the years from 2000 through 2006 and is subdivided into the programmes of ERASMUS for university education, COMENIUS for school education, LINGUA for foreign language education, GRUENDWIG for adults education and MINERVA for open and remote education. Each of these programmes, in a specific way relevant to its goals, provides for opportunities for assisting the development of information and communication technologies in the area of education. For instance, one of the goals of the MINERVA Programme is to ensure, through information and communication technologies, access to and diffusion of educational methods and resources on both national and European scales.

[11] *Bulgaria 2001* Programme Update

The World Bank grants loans for the drafting of modern educational standards, which will indirectly help the education in the area of high technologies.

Younger people demonstrate a growing interest in specialised studies in the area of high technologies. For instance, from among the applicants for the Technical University of Sofia, 3,836 have stated the major of Computer Systems and Technologies as their priority choice; 1,784 have expressed preference for Communication Equipment and Technologies, whereas for the remaining 32 majors, this number varies between 12 and 530. The minimum qualifying grade average for these majors was respectively 19.85 and 19.60 (against a maximum of 21). 567 computer science students are being trained at the University of National and World Economy. The average number of graduates per year is about 90. All of the 5,684 applicants for the 2000 maths test have ticked computer science as one of their choices. The minimum qualifying grade average for the full-time courses in this major was 22 for male applicants and 21.60 for female applicants (against a maximum of 24).

Threats to the Educational System as Regards High Technologies

Young specialists acquiring competence in the area of high technologies often leave the country. For instance, the salary of the heads of information service departments varies between US$ 150 and 250 for state organisations; US$ 550-1,000 for private organisations; information technologies company managers get between US$ 300 and 1,500; managers of foreign companies generate between US$ 800 and 2,500. Bulgarian programmers earn a salary of about US$ 220 to 500 in Bulgarian companies and US$ 300 to US$ 750 in foreign companies. The minimum salary US brokerage companies offer to information technologies professionals is US$ 2,000 per month.

Sociological researches from the second half of 2000 show that there is a steady tendency for emigration among highly qualified specialists. It is also supported by their families. More than half of the parents in Bulgaria advise their children to emigrate and are ready to invest more in their education in order to attain this goal.

Another observable tendency is the fast outdating of new competence and the constant changes of requirements to the skills of employees. This calls for a continuos trend of education, especially in the area of new technologies.

The Financial System and Technological Development in Bulgaria

Dimitar Rumenov, researcher, Center for Economic Development

Structural changes in the global economy in the last two decades have clearly outlined the dominant role of technological sectors in modern world. Boom in new technologies, emergence of completely new industries and newly established principles in the economy brought to the fore technological sectors as propellers of economic growth and development of the entire economic base in the future. The processes of economic restructuring would have been impossible without existence of advanced and modern financial systems in the countries that accomplished the technological breakthrough and launched the "new economy." It should be noted that the financial systems of these countries underwent serious evolutions and developed continuously so as to meet adequately the challenges of the new environment.

The current development of the financial system in Bulgaria cannot be different from the overall state of the economy. After the currency board introduction in 1997 the financial system stabilised, commercial banks demonstrated liquidity and robust capital adequacy, a new law on the stock exchange was adopted which promoted stock market structuring and regulation, the commercial law, the corporate tax law and a number of other regulations were significantly amended and improved. Over the last three years the economy has experienced a noticeable economic recovery and economic growth, though at far too slow rates.

Banking System State and Development

Current State of the Banking System

Presently the Bulgarian banking system consists of 34 operating commercial banks, including 27 autonomous or subsidiary banks, and 7 branches of foreign banks. As of 30 September 2000 total commercial bank assets exceeded BGN 10 billion, according to BNB data. Private capital, foreign private capital in particular, dominates the banking system. At the end of September banks with foreign capital ownership comprised 68% of assets, 65% of deposits and 89% of profit in the banking system.

In the last three years the Bulgarian banking system has restored its stability and credibility. The indicators of primary and secondary liquidity and capital adequacy exceed significantly BNB requirements. The state of commercial banks' credit portfolio improved considerably. At the end of the third quarter standard credits accounted for over 90% of the total credit portfolio, and reported and provisioned loss was at 7.8%. A sustained upward trend in bank assets evolved: an increase of 29.4% in comparison with 30 September 1999.

In recent years banks have pursued conservative lending policies. The share of extended credits for the last three years accounts for 30% of total assets. This ratio is much lower than internationally accepted standards by the Bank for International Settlements in Basle: 60 – 65%. Due to their low lending activity and preference for low-risk investments in bank deposits abroad and in government securities, banks' profitability as a whole is very low: return on assets was 2.3% as of 30 September 2000. It should be noted that the size of the banking system is too small even by the Bulgarian standards. In 1999 the ratio of bank assets to GDP was 36%, against recommended international norms of 95 – 120%.

The banking system structure in terms of bank size varies significantly. The three biggest Bulgarian banks, Bulbank AD, UBB and DSK Bank, hold 50% of total assets and 87% of total profit in the banking sector for the first nine months of 2000. There are 14 small banks whose balance sheet totals do not allow them to extend sizeable credits to enterprises and stay competitive on the market. The way out for these banks is to consolidate and thus enhance banking market competitiveness.

Increased presence of foreign bank capital creates conditions for improving the product mix on the banking market by introducing new products and services and by increasing the number of bank services provided in the country. This process is gaining momentum now, the first step being the restructuring of banks' organisational, management and marketing structures. In the foreseeable future – 12 to 18 months – positive changes relating to new bank products and enhanced lending activity are very likely.

SWOT Analysis of the Bulgarian Banking System

SWOT analysis of the current state of the Bulgarian banking system is presented in Table 5.

Table 5 SWOT of Bulgarian Banking Sector

Strengths	**Weaknesses**
➢ Stable and liquid financial system with high-quality credit portfolio ➢ Well developed branch network ➢ Good legal framework ➢ Strong banking supervision ➢ Market presence of recognised foreign banks: Citibank, ING, BNP, Uni-Credito, Raiffeisenbank, NBG, etc. ➢ 6. Sustainable upward trend in bank assets	➢ No access to credit for new companies ➢ High concentration on the banking market – the first three banks hold about 50% of total assets and 87% of the profits in the sector ➢ Very restricted credits – credits comprise about 29% of total system assets ➢ High collateral on credits: 160% - 200% ➢ High interest rates on loans and large spread: 8 – 9% ➢ Low profitability – return on assets is about 2.3% ➢ Lack of special treatment of credits extended to technological sectors ➢ Over 80% of the loans are short-term (up to one year)
Prospects	**Threats**
➢ Enhanced competition on the banking market ➢ Consolidation of small banks ➢ Introduction of modern banking products and services ➢ Banking market deregulation in compliance with EU requirements ➢ Development of flexible schemes for export financing	➢ Hypothetical possibility for portfolio worsening ➢ Slower growth rates than real economy growth rates

As regards strengths, it should be noted that the quality of banking system credit portfolio was very good as of 30 September 2000. Over 90% of the credits extended by commercial banks were standard, while loss accounted for about 7%. In the last several years a steady trend towards improving the quality of banks' credit portfolio has evolved, mainly due to BNB stringent supervision policy and prudent commercial bank lending. At present, major banking system weaknesses in terms of lending reflect their conservatism and restrictive credit requirements. Banks still require prime-rate collateral (first ranking mortgage on residential buildings, foreign currency, precious metals, government securities) amounting to 160 – 200% of the size of the requested credit. In most cases banks are conservative in accepting finished products, machinery and equipment, as well as other assets as security collateral. This poses serious problems for borrowers and is the major obstacle for obtaining bank financing. Interest rates on lev credits move within the range of 14% to 16% and the interest rate spread (the difference between interest on credits and deposits) is 8.5% - 10%. Commercial bank interest policies do not facilitate access to credit. No special lending conditions are provided for the companies in the technological sector. In general this industry needs medium- and long-term financing at initially preferential terms but at present about 85% of total extended credits have maturity of up to one year. With the exception of the big companies in the technological sector, access to credit for the other companies is severely restricted. Banks require high collateral on credit, large cash flows (preferably in foreign currency), export contracts, and a growing market share. Borrowers seek financing to fund their investments in machinery and equipment to meet domestic and international markets requirements, and to have sufficient working capital which will ensure market competitiveness in terms of price, term of payment and quality. Unfortunately, they fall into vicious circle and the way out is problematic.

Access to credit for new and start-up companies is severely restricted. Banks require more than 2- to 3-year accounting record and declared profit. Actually it is not possible to get credit on the basis of a business plan alone. Those requirements pose serious impediments for innovative firms in the technological sectors.

Short- and medium-term prospects for the banking system mainly reflect growing competitiveness on the banking market and subsequent positive trends for the banks' customers and the sector as a whole. The finalisation of the bank privatisation process in Bulgaria and ongoing post-privatisation bank restructuring pave the way for a new stage in the development of the banking system. Investment in new bank products and services becomes a major bank task, as continuously improved bank policy and marketing prove crucial to market development. In the last two years the banking sector was stable yet static, mainly due to a slowly changing economic environment and privatisation expectations. Currently a trend evolved towards a gradual market recovery, mainly reflecting banks with predominantly foreign capital.

In addition to market forces, the BNB is expected to boost "opening" of the banking sector to the real economy by certain relaxation of regulatory requirements for commercial banks. The strict regulatory framework was imposed with the introduction of the currency board but it could have a suppressing effect on the development of the bank market unless changes are introduced. Step-by-step and smooth banking sector deregulation is pending, given the country's commitments in the process of EU accession and compliance with the requirements of the European Commission and the European Central Bank.

The Capital Market

The Bulgarian capital market is completely structured and organised. Licensing of the Bulgarian Stock Exchange – Sofia AD at the end of 1997, adoption of the law on public offering of securities in 1999, which repealed the earlier law on securities, stock exchanges and investment intermediaries, establishment of the Central Depository, and intensive Securities State Commission's work on the licensing of investment intermediaries ultimately constituted the organised stock trading in Bulgaria. From an institutional and regulatory point of view, all prerequisites are in place for the capital market to perform its major functions: to transfer accumulated money stock to real sector financing, to attract foreign investment, and to increase investment opportunities.

The capital market is not operating normally, however, failing to be an actual source of financing resources as yet. Major points from SWOT analysis at the present moment are defined in Table 6 below.

Table 6 SWOT of Bulgarian capital market

Strengths	Weaknesses
➢ Well constructed and regulated market. ➢ More than 940 companies listed on the stock exchange.	➢ Low investment activity. ➢ Relatively long procedure for flotation of new securities on the market. ➢ Low investment culture of issuing companies. ➢ Restriction on newly emerged companies (up to three years) to float shares on the stock exchange. ➢ 5. Weak corporate management in issuing companies.
Opportunities	**Threats**
➢ Diversification of the type of traded securities: GDRs, preferred shares, etc. ➢ Floating of corporate bonds – currently – Prosoft AD (two issues), Albena AD, Energy AD	➢ Preservation of the current capital market position. ➢ Preservation of the possibility for companies to increase their capital on condition.

Another positive development, in addition to finalised institutional and regulatory structuring, is the fact that more than 940 companies are listed on the stock exchange. Regretfully, in the name of unbiased analysis it should be noted that the strengths of the Bulgarian capital market are not as numerous. In practice the market functions with a negligibly small part of its capacity. Investment activity is minimal. Absent are serious investors to allocate free resources. The market is "thin" and no clearly positive trend has evolved in the last 18 months. The widespread opinion of investors and experts is that securities traded on the floor of the exchange are not attractive. The reasons may be sought in two directions: the denial of the government to float packages of shares in the big enterprises earmarked for privatisation and weak corporate management combined with unsatisfactory results of companies listed on the stock exchange. Most of the companies are "registered" on the stock exchange but no actual transactions in their securities have been effected for months on end. Another problem is low investment culture. Few companies distribute dividends to their shareholders. The market is still overlooked as a source of attracting cheaper financial resources (compared with bank credit) and additional floating of shares is quite rare. This is also ascribable to relatively awkward Securities State Commission procedures for the listing of new shares. Access to the market for new companies is impossible. Some provisions in the Law on the Public Offering of Securities impede normal development of the capital market:

- possibilities for increasing on condition the capital of public companies. In practice this creates possibilities for increasing the capital of banks, insurers and other financial public companies only in the interest of some of the shareholders;
- the possibility set forth in the law for termination of the public status of companies with registered capital below BGN 200,000 by a resolution of the General Meeting of the company without tendering offers. Such a possibility allows to the majority shareholder or a group of shareholders having majority in the General Meeting to terminate its public company status without the consent of the other shareholders;
- the definition of a public company creates possibilities for these companies to circumvent obligatory securities trading on a regulated market. Again, exchange of shares outside regulated markets for government securities or other public companies' securities is allowed.

Financial and economic stabilisation in the country promotes development of the capital market in Bulgaria. In 1999 and 2000 the first corporate bonds were floated by the high-tech company Prosoft AD, a self-telling fact. In recent months new types of securities have been traded on the stock exchange: depository receipts of Deutsche Telecom and Deutsche Bank. Trade in government securities was launched.

Alternative Sources of Financing: Venture Capital Funds

Venture Capital Funds

Given the specific and dynamic development of the companies in the technological sector, venture capital funds are an extremely suitable source of financing. International practice shows that venture capital financing was at the heart of the boom in the technological sector in the last decade. The presence of such funds in Bulgaria is still very limited. At present, the following funds are operating in Bulgaria: Black Sea Fund, ECM-Fund, Caresbac-Bulgaria, EuroMerchant Balkan Fund and Global Finance. These funds invest in joint-ventures, the usual investment being from USD 0.5 to USD 6 million. An exception to this is Caresbac-Bulgaria, whose investment ceiling is USD 350,000. Venture capital funds began their activity in the country after the installation of the currency board, but their role in the financial system is still insignificant. Their investments are concentrated in the light and food industries, and in IT companies from the technological sector. Major reasons for the low activity of venture capital funds are:

- ongoing real sector restructuring;
- low market capitalisation of companies;
- differences between national and international accounting standards;
- heavy tax regime for this type of investment.

The financing of high-tech enterprises, including start-up companies through venture capital funds, is very perspective and adequate. This way innovative firms could get financing and access to managerial know-how, advanced marketing and new markets.

Conclusions

The Bulgarian financial system is dominated by the banking sector. The capital market and non-bank financial institutions still play a small role in the allocation of free financial resources. The measures that should be adopted in order to create better conditions for the financing of the technological sector are summarised in Table 7.

Table 7 Proposals for improvement of financial environment for technology companies

MEASURES	INSTITUTION
I. In respect of the banking system	
1. Regulation No. 9 – to review the severely restrictive definitions of risk-free collateral in paragraph 1, subparagraph 2 of the Additional Provision of the Regulation	BNB
2. Regulation No. 8 – Article 12 that specifies the assets with zero risk weight, not included in the risk component of banks' balance sheet positions.	BNB
3. Regulation No. 11 on bank liquidity which prompts banks to opt for short-term financing to ensure matching between attracted funds and claims	BNB
4. Amendment to the Civil Procedure Code, Chapters 22, 23, 33, 35, 36 - 42	Council of Ministers, National Assembly
5. Adoption of the international accounting standards for financial institutions	BNB, Council of Ministers, National Assembly
6. Active interest rate policy	Commercial banks
7. Tax stimuli for commercial banks on lending to high-tech companies – reducing the taxable financial result by the percentage of credits to the technological sector in the total credit portfolio.	Ministry of Finance, Council of Ministers
8. Setting up branch insurance funds	Branch organisations from the technological sector, commercial banks

II. In respect of the capital market	
1. Offering packages of shares in NEC and BTC on their privatisation	Privatisation Agency, Specialised Ministries
2. Public offering of minority and residual shares	Privatisation Agency, Specialised Ministries
➢ Changes in the tax regime: - reducing the financial result by the interest on corporate bonds; - tax exemption of the capital profit on holding securities over a certain period of time; - taxation of the capital profit of non-residents on a portfolio basis; - equalising the revaluation regime for long-term and short-term investments.	Ministry of Finance, Council of Ministers

Changes are needed in the technological sector itself to meet adequately financial market requirements:

- improving corporate management;
- observing the principles of the good management practice;
- strict accounting;
- developing investment culture;
- active marketing and financial policies.

Fiscal Policy in Bulgaria Compared to Selected European Ccountries

Lora Brusiiska, researcher, Center for Economic Development

Our competitiveness depends on making the most of our distinctive and valuable assets, which competitors find hard to imitate. In a modern economy those distinctive assets are increasingly knowledge, skills and creativity rather than traditional factors such as land and other natural resources.

This process must be led by the private sector – the main wealth creator – by investment in new business development, research, information technology and skills. The Government has a critical part to play in building the capabilities the Bulgaria needs to compete by: strengthening Bulgaria's capacity for innovation and risk-taking investing in the knowledge base, particularly in science and engineering improving the skills and capabilities of the workforce including by raising educational standards helping business make the most of information technology and R&D both at home and abroad.

Public authorities can support the innovative process in various ways. Framework conditions such as the educational and training system, infrastructure, the legal environment, and macroeconomic policies are important to support innovation. However, the two most focused policy instruments are government-funded R&D and fiscal incentives. Fiscal incentives are "horizontal" because they are available to all firms according to precise criteria. Government funded R&D is rather "vertical" since it is selective, targeting projects which are selected by governments, either for their own needs or to support industry.

One of the important fiscal incentives to stimulate R&D and new technologies in the European Union countries is the tax incentives given particularly to the investments in this kind of assets.

Current Tax Regime Achievements

Some of the particularly important achievements relevant to the tax laws and practices are summarised below.

Financial stability - this is one of the most valuable achievements of the Bulgarian reforms, and there is an obvious link between this achievement and the functioning of the tax system.

Improvements in the tax legislation - among the numerous changes to the tax regime coming into force from the beginning of year 2001, there are some obvious and important improvements recognising the needs of the economy.

Reduction of tax rates - As from 1 January 2001 the higher rate of corporate income tax is going to be reduced from 25% to 20%, and for so called small companies from 20% to 15%. The highest bracket in the PIT will be reduced from 40% to 38% and the tax free minimum shall be 100 leva. Concerning VAT, the six-month reconciliation period for VAT reimbursement payments will be changed to four months.

There is no doubt that all tax compliant businesses will benefit from these measures, which are likely to facilitate the achievement of a higher rate of tax compliance throughout the country.

Besides the reduction of the tax rates there have been other encouraging legal changes improving the tax regime. For example:

- The corporate tax allowable depreciation rates became more consistent with the economic realities.
- The thin capitalisation restrictions were limited to the cases where the debt financing exceeds equity financing.
- New Customs Act has been applied. Despite the initial difficulties in its application it represents a legal base for the modernisation of the Bulgarian customs practices.

In addition, it should be noted that the Bulgarian statutory accounting rules, which are interacting with the tax legislation, tend to go closer to the principles and standards accepted in the developed market economies. This is a very positive and important trend. An overview of Bulgarian tax regime of Bulgarian can be find in Appendix 7.

Specific Problems

The corporate taxes should allow genuine business costs to be offset against the actual business incomes. Anti-avoidance restrictions in areas like entertainment and other non-business expenses, depreciation (timing restrictions), pricing between related parties, and hidden distribution of dividends would not be seen as a difficulty.

Restricting costs associated with debt financing from unrelated parties

Foreign investors may not be prepared to invest in equity in Bulgaria, but be prepared to consider investing by extending a loan (or leasing out assets) to an unrelated Bulgarian business which cannot find equity financing. The current thin capitalisation rules may restrict (not only temporarily) the tax deductibility of the relevant interest cost which, in the described situation, is not associated with tax avoidance. The restriction is more likely to apply to long-term investment projects, which would hardly facilitate the needed structural reforms in the economy.

Taxing the interest twice

In accordance with the current rules if a Bulgarian bank extends a loan to a Bulgarian company, the interest will be a taxable income for the bank in all cases, and it may not be deductible for the company in some cases. This may result in double taxation of the interest.

Impossibility to offset capital losses against the capital gains

According to the current tax regime if a non-resident person realises both capital gains and capital losses as a result of a trade of stock in Bulgarian companies the gains will be subjected to the 15% tax at source, but the losses will not be deductible from the taxable base.

The above feature is seen as unfair and de-motivates the non-resident (potential) investors in Bulgarian stock. It also hinders the development of the Bulgarian stock market.

Possibly unintended taxation of initial investments

The CITA imply that the liquidation proceeds payable to non-resident investors are deemed to be "dividends" and as such are subject to 15% tax at source. There is no legal provision clearly excluding the initial investment from the taxable base. For example, if an investment of BGL 1 Million is invested in registered capital, and after that the company is liquidated without carrying out any business activity, according to the quoted provisions liquidation proceeds (which had become "dividends" according to the definition) will be subject to 15% tax in Bulgaria. Thus the investor will have to pay 15% of the investment as tax for the one-day of presence in Bulgaria.

Tax treatment of the payments for computer software

There are currently no specific provisions with regard to the tax status of computer software. CITA does not define in which cases the payments for the transfer of computer software is to be considered as royalties, and in which cases they should be treated as a business income.

As the volumes of the payments for computer software are likely to increase there will be an increasing need for characterising them as commercial income or royalty. This calls for the need of a specific legal provision. It should be noted that on 29 September 1998 the OECD has issued a revision of the Commentary to Article 12 of the OECD Model Tax Convention concerning software payments. Under the current OECD commentary, payments made for the acquisition of partial rights in the copyright (without the transferor fully alienating the copyright rights) will represent a royalty where the consideration is for granting of rights to use the program in a manner that, without such license, constitutes an infringements of copyright.

Need for Further Discussions of the Depreciation Rates

While acknowledging the positive developments in the rules relevant to the tax allowable depreciation rates there are much needs to be further improved so that these rules become sufficiently consistent with the economic realities.

There are no tax allowances on investment purchases and depreciation is deemed as expenditure only in a scope defined in the CIT.

For illustration, the rate applicable to computers and software (20% annually under the straight-line method) is commonly seen as unrealistically low by the relevant businesses. They think that the economic life of the computers and the software is actually much shorter. In most of the developed countries the accelerated depreciation of 100% for computers and software is applied.

High Taxes on Wages and Social Security Contributions

The very high taxes on wages and the relatively high social security contributions paid by the employer, which influence the lack of capacity of introducing new work places and qualification of the employees.

Employees are liable to make the following contributions on their account:

- 5.8% (as from 1 January 2001) deductible social security contributions;
- 0.8% (as from 1 January 2001) deductible unemployment fund contributions;
- 1.2% (as from 1 January 2001) health insurance contributions.

Employers are liable to payroll taxes for employees at the following rates:

- Social security contributions 23.2% (as from 1 January 2001)
- Unemployment fund contributions 3.2% (as from 1 January 2001)
- Health insurance contributions 4.8% (as from 1 January 2001)

On the other hand, the representatives of the software business say, that it is the major expenses they make (not the corporate tax), because the salaries in that field are comparatively high and they openly say that they are searching the ways for avoiding these taxes in order to minimise the expenses on employees.

8. Main problems concerning VAT are:

- Liability of VAT registrations arises if the turnover is more than 75 mill. Leva for the last 12 months. This is too high and many small companies cannot rich this level and cannot use tax credits. For comparison see Table 8 below showing the liability of VAT registration in the EU member states.
- There is 6-month reconciliation period for VAT reimbursement payments, which will be changed from January 1, 2000 to 4 months. Even though this waiting period for reimbursement of VAT is particularly disconcerting for investors. Especially for new investments this waiting period can present a substantial cost factor.

Table 8 Liability of VAT registration in EU member states

EU member states	**Minimum liability in EURO**
Bulgaria	***25,510***
Austria	22,400
Belgium	5,000
UK	65,500
Germany	12,555
Greece	6,000
Spain	0
Ireland	50,000
Italy	0
Luxembourg	10,000
Portugal	10,215 or 12,770
Finland	10,000
France	10,000
Sweden	0

Unstable and unpredictable tax policies

The Bulgarian tax policies are often unstable and unpredictable.

The problem comes from the lack of impossibility of tax planning. The tax legislation is often changed and in many cases imprecise, laws are accompanied by so called implementation rules, which clarify or even interpret the laws.

Twice within the last six years long-term tax incentives for foreign investors were adopted, and shortly after that – abolished. Indeed, it did not affect the already vested funds, due to the implemented favourable transitional measures. However, the planning process of some strategic investors was disrupted.

Lessons from Government Support to R&D in Developed Countries

Government Policy towards R&D and Innovation

R&D by private businesses is an important indicator of national innovation capacity, and OECD countries apply various approaches to improve their performance. Countries where business R&D is weak tend to adopt general programs and tax incentives, while countries with relatively strong business R&D often implement measures that apply to certain types of companies (such as start-ups, SMEs, or fast-growing or highly research-intensive firms), to specific sectors and "key technologies", or to specific objectives (such as increased employment of researchers). For example, employers in the Netherlands, who are responsible for deducting income tax and social security payments from their employees' gross salaries,

may reduce the amount they pay to the authorities in the case of R&D staff, thereby alleviating the wage burden of R&D.

Fiscal incentives may take various forms, which are an international comparison problematic for a detailed examination. Most OECD countries allow for a full write-off of current R&D expenditures (depreciation allowances are deducted from taxable income). Many of them also provide R&D tax credits. These are deducted from the corporate income tax and are applicable either to the level of R&D expenditures – flat rates – or to the increase in these expenditures with respect to a given base – incremental rates. In addition, some countries allow for the accelerated depreciation of investment in machinery, equipment, and buildings devoted to R&D activities.

Fiscal incentives and direct subsidies can be used as complements or as substitutes. There is no clear cross-country pattern, however. Some countries favour fiscal incentives, with relatively weak subsidisation rates (e.g. Australia, Denmark, and the Netherlands), whereas others focus more on direct financial support than on tax concessions (like Norway, the United Kingdom, Italy, Sweden, and Germany). Among the remaining countries two groups can be distinguished. A first group made up of Canada, Spain, the United States and France, provides both high fiscal incentives and government funding. A second group countries, which includes Japan and Switzerland, has a low level of generosity for both policy tools.

Both fiscal incentives and direct subsidies stimulate private R&D investments, at least in the short run. In the longer run, direct subsidies are more effective than fiscal incentives. This is probably so because direct subsidies lead firms to launch new projects, whereas fiscal incentives mainly induce firms to accelerate ongoing projects.

Financial Assistance and Guarantees

Most of the developed countries use different financial assistance to stimulate the economic expansion. The beneficiaries may be an individual or legal entity, public or private, provide they carry out activities contributing directly to the creation, development, conversion or modernisation and rationalisation of industrial and craft enterprises and, in certain cases, of commercial enterprises. Activities must be of general economic interest.

In order to stimulate economic expansion in certain areas of the country, the OECD countries' laws contain financial and tax incentive measures. The beneficiaries must carry out one or more operations, which will contribute to the realisation of the industrial, technological and regional objectives of the national plan. The laws may provide different types of incentives e.g., interest rate rebates, capital grants, state guarantees, employment premiums, various tax advantages, etc. There are also specific incentives available for small and medium-sized enterprises such as interest subsidies, capital gains, exemption from real property prepayment, accelerated depreciation, etc.

In addition to the benefits provided both by the investment incentive laws and by the tax incentives, the OECD countries use a number of other measures to encourage investments:

- energy saving incentives;
- scientific research incentives (financial, technical and research aids). A tax exemption is available for the additional employment of scientific personnel, personnel in charge of the export department or personnel in charge of the quality control department;
- export incentives (short-term financing of the exportation of plant and machinery);
- educational incentives (accelerated training to acquire specific skills);
- other incentives for companies which have temporary difficulties.

There are various other assistance programs available which are either designed to support small ad medium-sized business (e.g. favourable loans under the European Recovery Program) to promote technological progress and innovation, to improve the environment and to offer management constancy.

In Spain the Advisory Commission of Scientific and Technological research provide long term interest-free financing to promote R&D of new products or industrial processes.

Austrian R&D expenses are tax deductible at the rate of 112% of the actual amounts incurred provided the tax authorities certify that the research work is in the economic interest of Austria. No certificate is required if a patent has already been issued. The tax deductible amount is increased to 118% of actual expenses if the invention is used by the inventor himself and not licensed to third parties. Business enterprises may deduct donations to universities and other institutions dedicated to research work and acknowledged as such by the tax authorities up to 10% of the taxable profit of the preceding year.

The Industrial Development Agency in Ireland is the principal organisation responsible for promoting industrial development. It offers a comprehensive range of grant assistance and other forms of incentives. Projects eligible for assistance must:

- produce goods of an advanced technological nature for supply to international trading or skilled self supply firms within Ireland;
- produce goods for sectors of the Irish market, which are subject to international competition.

Repairs, maintenance and modernisation costs in Italy are deductible up to a maximum of 5% of the cost of depreciable assets held at the beginning of the financial period. Any excess over 5% is allowable in equal portions over the following five years.

Amortisation charges concerning the cost of patents and trade names are deductible each year, up to a maximum amount equal to one-third of the cost. The amortisation of trademarks is deductible up to a maximum amount of one-tenth of the cost each year. Amortisation in respect of the cost of licenses and other intangible rights in respect of the above assets are deductible over the duration of the useful life of the license, as provided by the contract or by law.

In France a tax credit is available for 50% of the excess of R & D expenses incurred during each calendar year from 1996 to 1998 over the adjusted similar expenses incurred during the two preceding years. For new companies, the tax credit is equal to 50% of the expenses incurred in the year of creation. This same amount will be used as the basis for the year following the year of creation.

The Tax Authorities have given a narrow definition of qualifying R & D expenses, which is only used for applying provisions relative to the calculation of the tax credit. Qualifying R & D expenses include payroll expenses and depreciation allowances for equipment directly involved in carrying out R & D programs. Expenses connected with the registration and maintenance of patents (excluding design, models and trademarks) qualify as R & D expenses, as does the depreciation allowance of patents (not know-how) acquired from third parties (including related parties); royalties do not. The maximum tax credit is limited to FF 40 million each year.

The tax credit is offset against the corporate income tax liability of the company. In case of excess, the excess is carried forward for the next three years. At the end of this period the remaining credit will be reimbursed to the company.

Where expenses are lower than the average expenses incurred during the two previous years, an amount equal to 50% of the difference is offset as the next base credit.

However, the offset is limited to the credit obtained previously.

Companies which have acquired new tangible or intangible fixed assets used in Belgium for business purposes can, under certain conditions, deduct a percentage of the acquisition cost of these investments from their taxable profit.

It should be noted that the investment deduction rate could be increased in some cases, e.g. up to 13.5% for assets acquired to reduce the energy costs of the company, R&D and new products or technologies.

Small and medium-sized companies (owned more than 50% by individuals and which have no co-ordination centre in the group) which have acquired new tangible or intangible fixed assets used in Belgium for business purposes can, under certain conditions, deduct a percentage of the acquisition cost of these investments from their taxable profit.

An increased spread investment deduction of 20.5% (tax years 1998 and 1999) is available for companies which acquire assets relating to R&D and new products or technologies (regardless of the fact of whether they employ less or more than 20 employees).

In almost all developed countries an accelerated 100% depreciation is available for computers and software, and in some cases for acquisition of goods related to R&D.

Conclusions

The Bulgarian businesses and individuals need a reform going beyond adopting particular amendments to the current laws and issuing specific tax clarifications.

What should be aimed at is a qualitative improvement of the daily ability of the tax system to identify, acknowledge, prioritise and solve the problems which (will always) exist in relation to the Bulgarian tax policies, laws and practices.

Focused investments are needed in structures with highest potential to provide quick, liquid, legitimate, sufficient and stable benefits to the State, without harming the economy.

The structures supporting the tax reform would qualify among the highest priority investment targets. The quick effects from such investments would generate resources for further reforms.

Enhancing technology transfer to the business and its capacity to absorb technology is a traditional pillar of innovation policy. A demand-led approach, the transfer of innovation know-how, and physical proximity to the source of the technology are seen as critical factors for success. Methods used include science parks, regional technology centres, liaison offices in academic and research organisations, and demonstration projects. Efforts should be put in developing new structures and tools for innovation policy. Three main aspects can be discerned:

- new administrative structures, based on the "system" nature of innovation;
- building awareness of the needs of innovation, and promoting a more intense dialogue between science, industry and the general public;
- developing a strategic vision, and innovation foresight;
- use of taxation and other indirect methods to encourage innovation and research.

Internet can immediately be used by the tax policy makers as a tool for communicating with the parties interested in (influencing) the tax policies.

For example, a well-structured draft tax policy document could be published on Internet with an invitation to the readers to comment on it and propose changes. The invitation may need to be promoted through other media. The draft could be periodically updated and upgraded, so that the new working ideas are added, and others could be withdrawn. The electronic way of communication would allow easy classifications of the inputs by (say) subject, time, quality, etc. This may bring-up interesting ideas, observation and considerations.

"The improvement of the tax system towards the application of the basic tax principles of the market economy will be subjected to the requirement for most efficient mobilisation of the internal resources. The basic objective of the tax policy will be the broadening of the tax base in combination with a reduction, subject to careful consideration, of the tax rates. The strengthening of the tax and customs administrations will be the basis for the higher rate of tax collection."

Small and medium-sized enterprises

Diana Hristozova, senior researcher, Center for Economic Development

International experience in the development of each particular national economy proves in practice the priority importance of the sector of small and medium-sized enterprises (SMEs) for the emergence and existence of competitive market economy and the achievement of optimal diversification in terms of the size of enterprises. SMEs are a source of new employment opportunities, they stimulate the development of entrepreneurial skills, contribute to strengthening of competition and reduction in regional discrepancies related to economic efficiency. Since economic development depends primarily on private initiative of individual persons or groups of various motivations, the state shall only establish, impose and provide favourable framework conditions for its free development.

SWOT of the SME sector

To create favourable conditions for the development of the sector is among the priorities in the policy of the Government[5]. The importance of the sector for the successful restructuring of the economy accounts for the increase of public attention toward the problems and prospects for development of the entrepreneurship, a result of which are the research and analysis of the SME sector that have been carried out recently. On the basis of the findings and the recommendations some of its most important advantages can be pointed out. The SMEs are:

- generator of higher competitiveness on the market;
- source of new employment opportunities;
- more flexible in crisis periods;
- more flexible in terms of internal organisational structure and are able to adopt more rapidly and readily innovations and new technologies;
- a favourable environment for development of entrepreneurial skills and business culture;
- closer to the ultimate consumers and can respond to their demands more rapidly and efficiently.
- At the same time, some of the SME weaknesses shall also be pointed out, namely:
- due to difficult access to financing, a great part of the SMEs are engaged with activities which are characterised by higher labour intensity than invested capital;
- a substantial part of the entrepreneurs do not have sufficient marketing, financial and accounting and legal knowledge, which hinders their business and reduces the efficiency of the enterprises;
- low access level and disregard of the real needs for information and consultation;
- underestimating of the quality requirements for the manufactured goods and services, especially in export oriented industries;
- most entrepreneurs are not well acquainted with the current effective international agreements and requirements and their influence on the liberalisation of the market.

The importance of SME for the national economy could also be outlined in terms of the opportunities for further strengthening and development of the sector and its impact on the economy toward:

- reduction of the unemployment rate;
- increase of economic competition;
- development of new high-technology industries;
- reduction of regional economic discrepancies;
- possibility to loop the production cycle and achieve higher efficiency by setting up clusters (related production) on regional or branch principle;
- enhancement of the economic growth rate at regional and national level;
- increase of the welfare of the nation.

[5] Revised Program “Bulgaria - 2001”, March 2000, “Economic activity” Chapter

The potential threats for the successful development of the SME sector are mainly in the following directions:

- impossibility to extend an individual enterprise by modernisation, expansion of activities and employment of new workers because of the adverse external (macroeconomic) environment - high taxation and insurance liability, difficult access to financing, administrative barriers etc. - and also due to the inability of the entrepreneurs to deal with its challenges;
- insufficient managerial skills of the entrepreneurs, inability to react adequately to liberalised markets and reshaping the manufactured produce and provided services in compliance with the European standard requirements.

Conclusions and recommendations

The improved conditions for development of the SME sector in Bulgaria generally, and of the technological SMEs in particular, shall be based on the system of purposeful activities for the implementation of the National strategy to encourage the development of SMEs and the Working Program for its implementation, the National Plan for Regional Development in the period 2001 -2006, the National Plan for Economic Development which is under preparation, as well as the revised Program "Bulgaria 2001". More precisely, the major objective of the National Strategy is to create a favourable institutional, regulatory, administrative, financial and competitive environment, encouraging the SMEs in Bulgaria. With reference to technology sector, the short-term initiatives in the working program provide for the establishment of business centres, technological parks, incubators, innovation centres, while the medium term initiatives (by 2001) include incentives for co-operation of SMEs with scientific and R&D units, technology and innovation centres and universities to solve concrete technical and technological problems, transfer of technologies and joint participation in scientific and research programs financed by the EU.

The importance of the SME sector for the economy, as well as its strengths and weaknesses shall be considered when it comes to defining the concrete activities. They shall be aimed at solving some more general problems at national level, but also specific problems at branch and regional levels. To this end, however, it is necessary to define the priority sectors in the industrial policy of the country, considering their competitive potential, on which the efforts for the improvement of development conditions will be focused. Those efforts do not imply state subsidies or any special preferences - tax, credit or other - but purposeful actions to support their development. Allow me to short examples in this respect.

At national level the selected priorities shall include high-technology and innovation activities businesses, and part of the most important argumentation is that: they contribute considerably to the modernisation of production and enhancement of the produce competitiveness; the country has traditions in their development, which should be kept and expanded; we have highly qualified specialists whose labour is comparatively cheap and who shall be motivated to work in the country and not abroad; our country is comparatively poor in natural resources and we shall focus our efforts to develop industries with relatively high labour share, which in addition shall be of high quality since one of the future development objectives is to increase the standard of living, as on the one hand the population is not numerous and it is ageing, on the other energy consuming and inefficient industries become less and less competitive due to the ever increasing prices of energy resources. Some concrete measures which can be undertaken are for example: priority building of technology parks and "one stop shops" (which also must have a very concrete purpose, as the specific peculiarities of the different in essence businesses make, at this stage, too ambitious the task to collect in one absolutely all administrative procedures), since the purposeful support of high-technology and innovative industries and services would have a comparatively higher medium term macroeconomic effect.

At regional level, if, for example, a priority problem that needs to be solved is the high unemployment rate, considering in detail the characteristic features of the regional economy and the above mentioned data about the SME sector, reserves for development of SMEs and increasing employment in them may be sought in view of the relatively low average employment rate in one enterprise. Attention shall be focused on looking for development opportunities in the branch of "Services", where the rate of employment is substantially higher than the average for the country - one of the indicators of its relatively

high competitiveness. Should we enter in greater detail, that could be design and program provision and the related services, where average employment rate, average turnover per employee and operational profitability are the highest. Within the "Industry" branch, the relatively most competitive production is the production of medical equipment, precision apparatuses and instruments, as the SMEs having such business account for the highest relative share in the sector and its turnover, a relatively high share in employment rate, average turnover per employee and achieved operational profitability.

Naturally, the given examples are purely theoretical due to lack of sufficient information and the relatively old and insufficiently precise data that have been used for the purposes of the analysis herein. Should there be available enough precise, full and up-to-date data, a similar approach could be used to solve concrete practical problems.

Sector Analyses

Software Industry

Georgy Mihaylov, researcher, Center for Economic Development

General information

Background of the software industry in Bulgaria

In the frames of the former socialist co-operation of the CEE/NIS countries, Bulgaria had the specialisation in Electronics. For the last three decades a lot of hardware and software specialists have been educated in the technical high schools all over the country. They have been working in the leading state Institutes and managed to form a real technocracy class of well-educated professionals.

After the changes in 1990 the powerful Bulgarian electronics industry lost its socialist markets and the production decreased very fast. The huge state-owned electronic enterprises collapsed and at the same time in 1990-1992 a great number of small private IT firms appeared on the Bulgarian market.

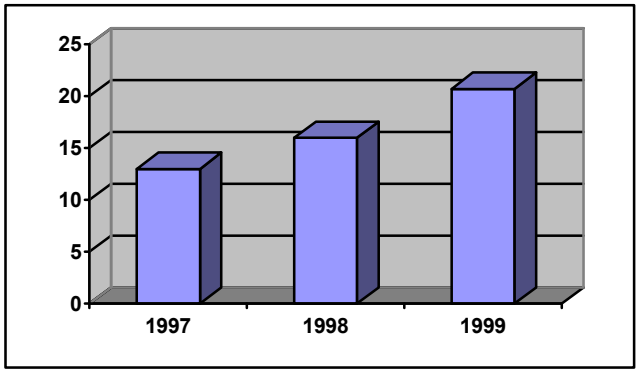
The high potential of Bulgarian IT resources (well-educated professionals and relatively good basis for development) was the reason for the designation of electrical engineering and electronics industry as a strategic sector and giving this sector priority in long term development programs. These priorities are also due to the efficient export record of the sector. In 1998 this sector's production accounted for 3.1% of the total industrial output.

According to some Western experts, nowadays IT development in Bulgaria is similar to the IT level of Greece and Portugal.

For the period 1997-1999 the average annual IT sales have been $132.6 m[12]. The hardware part shows a tendency to decrease and the software part increases each year. Software development is considered as one of the main forces driving to the growth of the Bulgarian IT market. Packaged software comprises 12.7% or $16 m of the overall IT sales in 1998 ($127 m). The share of the software market segment in 1997 was less than 11% or $13 m.

IT market volume in Bulgaria reached $153 m in 1999. The software purchases for the same year are $20.7 m or 13.5% of the overall income.

Figure 11 Software purchases (m US$)



Source: IDG

A comparatively new field in the Bulgarian software market is the ERP (Enterprise Resource Planning) market, which started its development in 1996. Till November 2000 the total number of ERP[13] installations equals 56, about 40 of them being developed during the last two years. The potential clients

[12] All figures quoted in this paragraph are taken from IDG surveys.
[13] The information about ERP is acquired from CBN.ChronoAnalysis. Bulgarian's IT market Business Analysis. Edition V, VI

of ERP software are estimated at almost 500 and this fact was the reason to attract ten of the world famous ERP vendors (amongst which is the German SAP), along with several Bulgarian firms which develop ERP software. It is interesting to mention the key parameters for selecting the ERP customers - potential clients are companies with more than 3 million USD annual turnover and annual IT budget more than 50 thousand USD.

The CAD/CAM/CAE software market is also developing in Bulgaria. At the end of 1999 there are around 40 companies customers of the CAD/CAM/CAE software, and more than 20 international vendors exist on the Bulgarian market.

Table 9 The biggest IT market centers are represented in the following table:

Center of the Administrative Area	Market Share (%)
1. Sofia	57.5%
2. Varna	11.1%
3. Burgas	4.9%
4. Stara Zagora	3.3%
5. Plovdiv	2.8%
TOTAL:	**79.6%**

Source: CBN. Chronoanalysis: Bulgarian IT Business Analysis.

The remaining 20.4% are almost equally distributed among the smaller administrative areas.

Bulgarian software firms – number, specific characteristics and allocation on the market

The number of IT companies on the Bulgarian market has been constantly growing for the last years to reach more than 1100 in 2000.

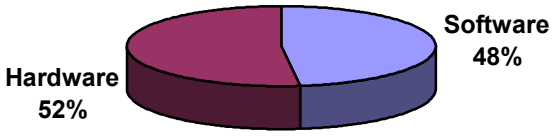
Table 10 Number of IT companies on the Bulgarian market

Year	1995	1996	1997	1998	1999*
Number of Active IT Companies	**816**	**907**	**964**	**982**	**1050**
Growth (%)	**base**	**11%**	**6%**	**2%**	**6%**

Source: CBN. Chronoanalysis: Bulgarian IT Business Analysis. (* - Estimated results)

Nearly half of the active firms on the Bulgarian market are software oriented.

Figure 12 IT firms in Bulgaria



Source: "Elaboration of a marketing concept" - LIMASOL Consulting Agency

Most of the software firms (75%) were created just after the changes - in the period 1991-1994. During the last two years appeared about 10% of them.

There is a growing number of software oriented companies, which are working on assignments entirely for foreign markets. The main reason for this tendency is the great number of high-qualified professionals who sell their labour at comparatively low price and thus attract foreign employers who seek for good quality at low costs.

The volume of software market in Bulgaria is showing the same upward tendency and have reached almost 71% absolute growth for 1999 compared to 1998. The annual sum of the balance sheet value of software products in banking, financial, insurance, non-financial sectors and privatisation funds equals 18.5 m US$ at the end of 1998[14].

Not surprisingly, 98% of the software companies are private. All of them are part of the SME-sector of the industry. The biggest (ProSoft) has 232[15] employees and there is a great number of micro-firms that have up to 10 persons. Actual figures show that 95.1% of the software companies have personnel up to 10 persons[16], and 99.8% are up to 100 persons. It is important to point out that the average turnover generated by the software industry according to the size of the company is as follows - BGN 24 m for micro-firms, BGN 280.1 m for companies with 11-50 persons, BGN 2418.1 m for those with 50-100 persons and BGN 4379.9 m for large companies.

If we examine the structure of the turnover as per the size of the enterprise we see that almost half of the turnover is generated by the micro-firms - 48.9%. Compared to other branches of the IT industry this indicator reveals that small and medium companies in software industry show highest results in relation to large firms (**Error! Reference source not found.**).

Table 11 Structure of the turnover as per size of the enterprise

Number of persons in the firm	Up to 10	11-50	51-100	101+
Total	**22%**	**17.5%**	**6.7%**	**53.8%**
Industry	**5.2%**	**7.6%**	**5.7%**	**81.4%**
Services	**37.6%**	**25.1%**	**6.8%**	**30.4%**
Software	***48.9%***	***27.1%***	***10.2%***	***13.8%***

Source: National Statistical Institute

The above figures are pointing out the significant role of the small and medium software companies and should concentrate the attention of the government in improving the business environment in which those firms are expected to create and develop successful products.

A good deal of information can be derived by examining the profitability of the companies (calculated as per size of the enterprise).

Table 12 Operative profitability of a company as per size of the enterprise (BGN)

Number of persons in the firm	Up to 10	11-50	51-100	101+
Total	**4.8**	**1.9**	**1.7**	**5.1**
Industry	**8.6**	**2.9**	**2.8**	**4.9**
Services	**4.3**	**2.2**	**1.2**	**5.7**
Software	***10.7***	***2.1***	***4***	***4.8***

Source: National Statistical Institute

In general, the situation in the country shows that SMEs operate more unprofitably than the large enterprises. They realise 35% less profit for BGN 100 turnover as compared to the large enterprises. In contrast with the common situation on the market are the results of the SMEs in software industry. We see here profitability more than two times bigger for micro-firms in comparison with the large companies. This is quite a good feature for the branch, as we all know that small enterprises are more flexible, adaptable to environment and open to new technologies, which is crucial for the industry. At the same time they have the disadvantage to be more dependable of the market and have difficulties in promoting and advertising their products.

As it was previously mentioned the software companies' personnel is very well educated, and in this way has lots of advantages for the foreign investors in the sector. The salaries of the software specialists are

[14] CBN. ChronoAnalysis.
[15] See TOP 100 IT companies (IDG)
[16] Information about SME is derived from National Statistical Institute statistical book.

higher than the average salaries in Bulgaria. About 30%[17] of the personnel receive between BGN 300 and BGN 600 monthly salary, and there are around 5% of the software experts whose monthly salaries exceed BGN 2 000. These amounts may vary for different companies, but the general trend is that the least salaries are in the state owned firms and the biggest - in private companies with mostly foreign capital.

Unemployment among the IT specialists is very rare. Not so good is the fact that there is a growing number of young programmers who tend to leave the country in pursuit of better working conditions and of course far better payment (e.g. average monthly salary in Bulgaria is DM 600, and in Germany - DM 7 500).

The actual allocation of the software producers in Bulgaria is quite the same as the whole IT market allocation. Most of the companies are situated in Sofia (86%). The rest 14% are shared among Varna (5%), Plovdiv (3%), Russe, Burgas and Veliko Tarnovo 2% each[18].

Hardware market in Bulgaria

Analysing the software industry in Bulgaria we should take into consideration the situation on the hardware market, since both industries are closely related and often companies are presented in both software and hardware markets. When we examine the data for the last few years, we notice that there is the same upward tendency and a steady growth in the volume of the hardware market. The following table shows the exact figures of the import of hardware in Bulgaria for a three-year period.

Table 13 Computer Hardware Import

Year	Import of hardware	Growth
1997	$102.9 m	+7.7%
1998	$133.1 m	+29.3%
1999	$173.3 m	+30.2%

Source: CBN.

According to latest IDC surveys the Bulgarian PC market has grown by 18% in the third quarter of year 2000, compared to the same period in 1999. The desktop computers dominate with 91,8% market share, followed by notebooks and PC servers. Studying the trend in PC market for the last few years shows the same tendency of constant growth. The reason for this growth could be either an increase in the total number of PCs in Bulgaria or upgrading the already existing ones. Either of these two reasons is a positive factor for the development of IT industry in Bulgaria and proves that the world progress and up-to-date technologies are well accepted and desired by the people.

The dominating companies on the PC market are IBM, Compaq, HP and the Bulgarian firm Most Computers. Although they form the bigger part of the market, it is important to mention that they sell absolutely to corporate clients. Most of the home users could not afford a brand PC machine, and this is the reason for the existing of the so-called "Black market". It is formed by a great number of micro-firms that assemble PC machines and sell their products without VAT. The elimination of this sector of the Bulgarian PC market or at least limiting it to a certain extent should be achieved through modernising the tax policy concerning IT industry as a whole. This is one direction in which the government and major IT associations in the country should work together for the improvement of the situation in the industry and bringing it up to the world standards.

[17] IDG survey - "Salaries in IT industry"
[18] CBN. Chronoanalysis.

Table 14 Bulgaria ICT Market Characteristics (August 2000)

PC Installed (home)	18 000 Units
PC Installed (business)	210 000 Units
PC connected to Internet	12% of all PC
Internet users	150 000 (constantly growing)
Number of ISPs	over 100
Fixed Line Penetration	33%
Mobile Penetration	6%

Source: IDC Central Europe Research

These figures indicate the current state of the information and communication technologies in the country. The fact is that they are subject to permanent increase and thus prove that Bulgaria has the potential to take part in the world progress.

External factors for growth of the software industry in Bulgaria

State IT projects

The most attractive potential clients in the country are the government administration, state and private companies, privatisation and investment funds. The biggest IT projects during 1999 were implemented in the government sector and the major state owned enterprises. The state administration is the largest customer of software products in Bulgaria - it stands for over 60% of the market.

The major projects for integrated complex information systems were implemented in the Medical Insurance Bureau, the National Social Security Institute, The National Statistics Institute etc. Among the biggest software clients were the National Electricity Company, the National Railway Company, the national telecom BTC and others.

Foreign companies collaboration

Bulgarian software market attracts the biggest foreign software companies. (See Table below).

Development of software for international clients is becoming more and more preferred area of performance for Bulgarian software companies. Lots of them have already established beneficial partnerships with German, American, Canadian, French, Dutch and Japanese companies.

Table 15 Foreign Companies in Bulgaria

Company	Bulgarian partner
Adobe	ACT soft, INFOGUARD
Inprise	Interprogramma, Power Partner
Lotus	Latona Development, NT CHS
Compuware	SPS
CA	INFOGUARD, SPS
Corel	ACT soft
Informix	NDB informix
Autodesk	ProSoft
Autodesk	Representative office
Novell	NT CHS
Oracle	Representative office
Progress	CTC software
Sybase	Global Consulting
Symantec	ACT soft

Source: IDG survey, Oct.1999

Government actions

The government actions in the direction of building IS were synthesised in the National Strategy for Development of the Information Society, prepared in the end of 1998. It represents a general plan for development of the IS in Bulgaria based on the analysis of the work done and the prognosis for the actions to be taken.

In the sphere of IT production the government plans building High-Tech Parks which will help to rebirth Bulgaria as a leading IT centre in Eastern Europe. The expectations are highest in the software development, for the sake of which the government undertook unprecedented antipiracy campaign.

IT events in Bulgaria

It is important to mention that Bulgaria has developed list of events with a history of several years, which are obviously well accepted by the public and IT companies. The interest in these IT forums, conferences and exhibitions shows a steady grow and is a direct proof that the country has a great potential in this sector of the industry. Below is the calendar of IT events in Bulgaria for year 2000.

Table 16 Y2000 IT events in Bulgaria

Event	Date	City
SISFF 2000 (Sofia International Security and Firm Safety)	March 15 - 18	Sofia
Office 2000 (office equipment)	April 4 - 8	Sofia
American Tech '2000	April 10-14	Sofia
Bulorga 2000, Telecomex 2000	April 17-20	Sofia
Plovdiv International Trade Fair (Home products and technologies)	May	Plovdiv
Bulcontrola (database automation, measuring and control equipment)	May 30 - June 2	Sofia
Bank Information Forum	May 25-26	Sofia
IEE (Internet and Electronic Entertainment)	June 1 - 4	Sofia
PC World Software Show - Exhibition of domestic software products	September 28 - 3 October	Sofia
International Plovdiv Fair Autumn '2000	September 29 - 3 October	Plovdiv
Second International Conference for e-Business - under patronage of European Commission and Ministry of Finance	October 17-19	Sofia
Telecom'2000	October	Varna
Information Society	Beginning of November	Sofia
BAIT Expo	November 21-26	Sofia

University IT education

IT education in Bulgarian universities is of great importance for the future of software branch in the country. Bulgaria has a tradition in technical education although there are some problems, which are still present in most of the universities. Mainly those are problems with the equipment and educational facilities and most of them are to be solved in the near future.

One of the optimistic facts is the growing number of universities that have their own Web site - 92.7% in April 2000 (88.1% in October 1999). That fact alone is to prove the openness of the Bulgarian universities to new technologies and the desire to give their students the chance to become a part of the world's latest achievements.

Apart from the standard university education the Ministry of Education and Science (MES) has taken some initiatives to support training of IT specialist by companies which have leading positions in IT industry. A good example of that is the agreement between MES and ORACLE for strategic partnership,

according to which the company will provide universities (and later some technical schools) with its training program for modern information technologies. Another leading company on the software market - Netage Solutions has proposed to create IT laboratory together with some leading universities. The idea was very well accepted and some other major companies (Microsoft, 3Com, Lucent) indicated their support for the initiative.

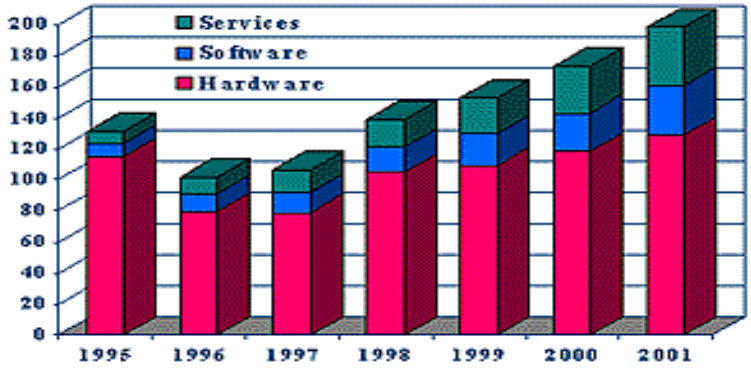
There are 12 universities in the country that offer IT education and among the most important are Sofia University "Kliment Ohridski", Technical University - Sofia and University of National and World Economy.

Software industry - SWOT Analysis

Basic trends in IT industry

After examining all the data presented for the analysis it is clear that software industry is a constantly growing branch in Bulgaria. On the charts below are shown the tendencies of development of the three aspects of IT industry - hardware, software and services.

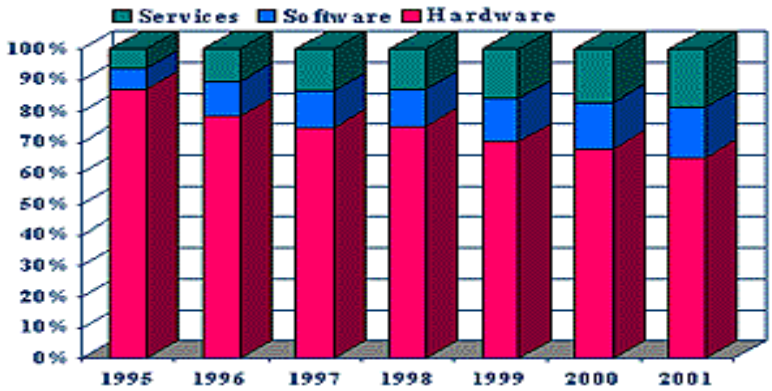
Figure 13 IT Market Development in Bulgaria, 1995-2001*, (USD m)



*Source: IDG. (*2000 and 2001 - estimates)*

The decline for 1996 and 1997 is due to the collapse of the Bulgarian economy as a whole in that period (inflation was 310% for 1996 and 578% in 1997[19]). After that temporary decrease there is a steady upward trend for the last three years, which is expected to continue in the future. The overall revenue growth is a bit retarded because of the declining value of the hardware segment, but at the same time there is an increase in the market growth derived from the spending on software and services (see chart below).

Figure 14 IT Market Development in Bulgaria by Category, 1995-2001*



[19] Source: National Statistical Institute statistical yearbook.

Source: IDG.(*2000 and 2001 - estimates)

Lots of Bulgarian software firms tend to work for the foreign markets. Partly that fact is due to the limited capacity of the Bulgarian market in contrast with the growing need for software professionals abroad. Another good reason is that most of the small local companies cannot afford to invest in software technologies, or are still not convinced in the use of those.

Software companies in Bulgaria can be divided in two categories: product-oriented and production-oriented. The first type comprises firms that create specific software products, earning from its program code and investing in its support. They sell "know-how"

The production-oriented firms are more like software conveyors. On the input they receive information as an assignment and on the output they produce encoded information. They sell programming and assembling labour.

SWOT analysis of the software industry

The table below represents the basic characteristics of the software industry as derived from the SWOT analysis. A detailed explanation of each feature is given after the table.

Strengths	***Weaknesses***
➢ High quality of companies' personnel ➢ Quality products at competitive prices ➢ International experience (project participation) and relationships ➢ Customer orientation as a result of a good marketing ➢ Combination of software and hardware abilities ➢ Flexibility and good distribution policy.	➢ Lack of financial resources ➢ Lack of marketing and advertising skills (poor management) ➢ Limited domestic market area and the lack of new markets. ➢ Lack of western partners. ➢ Some small firms (10%) show as a weakness their size which is not allowing any large projects' participation.
Opportunities	***Threats***
➢ Market expansion due to new products, ISO certification, better distribution and customer support ➢ Access to the international markets via increasing the export capacity ➢ Outsourcing ➢ Expanding new software sectors (Internet, Multimedia, e-commerce) ➢ Possibility to participation in big national projects ➢ Foreign investments' increase ➢ Packaged software/Application Solutions/ ERP development	➢ Loss of staff due to emigration ➢ Poor legislation related to the IT-sector ➢ Unfair competition on the domestic and international market ➢ Loss of clients ➢ Lack of financial resources for further development and modern technologies ➢ Lack of information for foreign markets

Strengths

There is no doubt in the fact that one of the most important assets and principal strength of the Bulgarian software industry is the highly qualified personnel. Bulgarian software developers and programmers are well known throughout the world and are often sought for their professional knowledge and willingness to work hard for lower wages.

Another advantage of the Bulgarian software firms is that they are able to offer high quality products at competitive prices. The small size of the domestic market (which is a negative sign by itself) can also bring some benefits and several Bulgarian firms already took advantage of that. The limited market is not attractive for the world leading software firms and thus some smaller firms specialize to meet the needs for entirely Bulgarian application software (Datecs, Ciela etc.).

Another positive feature of the software firms in Bulgaria is the fact that they are customer oriented. They are mostly private and they do not suffer the burden of the state-owned enterprises. They are flexible and competitive, always seeking for new opportunities for development and contacts.

Weaknesses

The crisis situation in Bulgaria causes the lack of financial resources and that definitely has a negative impact on every industry sector in the country. Software branch is not an exception. Software companies are deprived of the opportunity to hire more people and invest in latest technology innovations. Lots of smaller Bulgarian firms could not provide the financial motivation for their personnel and as a result more and more software specialists tend to leave the country in search for a better reward for the work they are supplying.

Lack of financial resources is also an obstacle for participation in international fairs, conferences and communication with foreign partners and markets.

Many of the companies show as a main setback of the industry the lack of efficient network of expert employees and management. The level of management in most of the Bulgarian software companies is quite low and the need of management expertise is becoming more and more tangible. This obviously is related to the lack of economic background of the software managers. In most cases (mainly small firms), the manager may be a very qualified engineer who has no skills in marketing, business planning and management.

Another indisputable fact is that a great number of Bulgarian educational facilities are quite outdated and the lack of qualified teachers in the field of programming and software development is becoming more noticeable with the time. There is the possibility that in some years the major strength of Bulgarian software firms - qualified personnel will no longer be so realistic.

As mentioned above many of the software firms consider the narrow frames of the domestic software market a great disadvantage and major obstacle to the full utilization of the programmers' potential.

Opportunities

The survey showed that most of the software companies are quite optimistic about their future development and perspectives.

Concerning opportunities on the Bulgarian market is closely connected with the overall performance of the Bulgarian economy as a whole. For the last few years Bulgaria have already made some of the most important steps towards ensuring a stable and favourable environment for creation of a free and competitive market. During the last 12 months we witnessed the issuing of an Order that brings Internet Service Provision under a free regime. There was also some progress in planning for the Information Society through the approval of a strategy and the establishment of a Co-ordination Council. Major software companies are ready to co-operate with the government and have prepared some necessary steps, which need to be taken and which will have positive effect over the IT industry as a whole.

One serious opportunity for development of the software companies in the country is utilization of the possibilities of Internet and e-commerce. In order to achieve the best results out of this sector of the industry, the companies need full support of the Bulgarian government. There are already a few steps made towards improvement and synchronization of Bulgarian legislation concerning IT industry, but there are still a lot of problems that need to be solved.

Many of the firms anticipate expanding their activities as a result of the development of new products, improving their distribution chains and certification under the ISO standards. It is important for the software companies to succeed seizing that opportunity, because in the extremely fast development of the IT market it is crucial to expand and make new contacts as soon as possible. Bulgaria's integration to the EU is the best way for the companies to collaborate with western partners, take part in mutual projects and increase market area.

About 1/3 of the software firms see as an opportunity gaining access to the international markets. We know that Bulgarian companies in the software industry are mostly micro companies with limited resources (both human and financial) and it will be a great advantage if they manage to attract the attention of foreign partners and customers. This will result in an increase of their competitiveness and will improve their image on both domestic and foreign markets.

Another opportunity for the software companies in Bulgaria may come with the establishment of high tech parks in the country. The government plans to build such parks with the co-operation of some major companies and universities, hoping that this will bring about the rebirth of the country as a leading IT centre in the region.

The software industry was supported also with the unprecedented antipiracy campaign that took place recently. At present the production of illegal compact disks is almost entirely destroyed and currently there is an offensive against the use of unlicensed software going on.

Attracting foreign investment is another opportunity for the successful development of the sector. Last year (1999) EBRD finalised an earlier approved project with one of the Bulgarian ISPs - Orbitel. The core of the deal was a EUR 0.7 m investment in the provider in order to support expansion of the company's retail services.

In November the biggest deal concerning ICT industry took place - Austrian company EuroproNet bought major share of the leading Bulgarian ISP Spectrum Net. The deal accounted for $5 m invested in Spectrum Net till end of 2002. The interest of this and some other foreign companies in Bulgarian ISPs shows that the country has potential and at the same time is a direct proof that Bulgaria is no longer isolated from the world tendencies and progress. The presence of such strong international players on the Bulgarian Internet market will lead to a more competitive and faster developing market, which is a benefit for all corporate and home clients in the industry.

Another interesting fact that appeared recently on the Bulgarian IT market is the initiative taken by Bulvetures JSC. It is a Bulgarian company, which provides venture capital for small IT firms and start-ups. Bulventures JSC have already agreed on the first two investments in Bulgarian software and Internet firms, and the expectations are that the financing will reach $5 m till the end of 2001. Except with the financing, the company will help its partners with the marketing of the products both in Bulgaria and abroad.

Threats

Analysing the results of the survey we came to the conclusion that software firms in Bulgaria are basically concerned with the business environment in the country. Despite the important steps towards liberalization and support of the IT industry taken by Bulgarian government there are still a lot of things to be done. The branch organisations (BAIT, BAII etc.) have declared their desire to co-operate with the government and announced their requirements concerning changes in IT sector.

The unfair competition and pirated software usage are among the reasons for a big deal of the losses both for the country and the software companies. Despite of the antipiracy initiatives taken by the government and supported by most of the software firms, Bulgaria is still suffering from the negative consequences of this situation on the market. According to Business Software Alliance (BSA) the country is losing about $2 m annually (tax loss) as a result of the using of pirated software. The annual loss of the large software companies in the country is estimated at about $11.2 m, and more than 80% of the software in Bulgaria is pirated[20]. A closer study of the origin of software used in Bulgaria shows that nearly 100% of the software used at home is pirated and only the state administration uses entirely licensed software.

Another serious threat that Bulgarian software companies are facing these days is "brain drain" - many high-qualified programmers tend to leave the country in search for better work conditions and payment.

[20] The figures presented here are taken from BSA surveys and all information concerns 1999. A comparison table for some European countries and Bulgaria is given in the Appendix.

The initiatives of Germany and USA towards increasing the number of "green cards" granted to software specialists is one of the main reasons for those troubles of Bulgarian firms.

A significant problem of Bulgarian software companies that have no access to foreign capital and investment is finding funds for the constant upgrade that is required for such a company to stay on the market. Each firm needs some initial support and those who rely only on their own market performance are likely to collapse if an unexpected change in the macroeconomic environment takes place.

The lack of corporate market in Bulgaria is another threat, which results in the poor state of development in some of the Bulgarian software firms. Most of the money comes from the orders of the State Administration, which is supported by foreign funds and organisations, such as The World Bank, The European Bank for Reconstruction and Development (EBRD), the TEMPUS and PHARE programs. A bigger part of the privatised large enterprises cannot afford to invest in software products and modern IT, except those of them that are purchased by foreign companies. As a result of all these facts only a shortlist of big software firms get the chance to work for a serious corporate client.

According to some software experts a negative sign in the Bulgarian software market is also the lack of real software products designated for small office and home use (the so-called SOHO segment).

Proposals for future development of the software industry

Analyzing the information presented above allows us to draw up a shortlist of some major problems that need to be solved for the successful development of the software industry in the future.

First of all software companies or their representative associations should work in close co-operation with government and define a detailed list of requirements and motives for those requirements. Working together is the best way to provide the basis for creation of new and improvement of the existing laws related to the IT sector. Because IT, Internet and communications are areas in which the advanced countries have already achieved a certain degree of renovating their legislation, Bulgaria could use the experience and expertise and thus avoid all mistakes of the pioneers.

In the last few years the data shows that the biggest customer of software and hardware firms is the state administration. This makes it a desired target for all companies that are active on the market. That fact is the reason for speculation and the best way to improve the system will be to make a revision of the Procurement Act and bring it up to the standards. There should be complete publicity and liberalization of this sector of the market in order to sustain the competitiveness of all companies. And the fulfillment of this task will lead to a better result both for the state and the IT industry.

The welfare of the software firms will also help solving the problem with "brain drain". In order to keep qualified professionals in the country, the companies should provide the motivation that these experts find abroad.

The problem with pirated copies of software should also be revised and there are some things to be done in order to improve the current state of the situation. We must mention that the existence of pirated software in Bulgaria is not due to any serious flaws in the legislation. It is mostly connected with the problem that the firms do not obey the law and the institutions that should check for this are not doing their job. The fact is that we have a good law relating illegal trade of pirated software, but there are problems in execution of this law.

Conclusion

The performed analysis and the experts' opinion prove that the IT sector and software industry in Bulgaria are in comparatively good state at the moment. The country has the human potential and the real opportunity to become one of the leaders in Information Technologies development in this part of the world. Up to now Bulgarian IT companies have managed to sustain the good image that the country had in the past. It is a matter of improving the overall economic situation in the country and assuring a favourable environment for foreign investments. Having in mind the low state of financial provision of the local software firms, supplying some foreign capital can be crucial for the industry.

One of the main problems that Bulgaria had to suffer last years was connected to software piracy. Even though a lot of Bulgarian businesses and all state administration structures are prone to using legal software, there is still a good percentage of users who prefer pirated software with bad quality instead the original one. The good news is that many world famous companies (Microsoft being the best example) realised the poor state of Bulgarian home and corporate customers and took the initiative to sell their products at lower prices, more affordable for the local businesses.

Encouraging are the forecasts of IDC for IT business perspectives in the near future - according to IDC specialists the growth in Bulgarian IT business till 2004 will be 12.5%. Having in mind the upward tendency in the software market we witnessed for the last few years it is clear that the industry has a steady background and it's in our hands to fulfill the good forecasts.

Microelectronics

Prof. Kamen Filiov, director, Technology Center Institute of Microelectronics

Bulgaria is among the few countries in the world developing their own microelectronics, while Bulgarian designers of integral circuits and technologists have proved as specialists highly-acknowledged on the high-tech market. Main reasons for this are:

- there was a relatively well-developed microelectronics sector in Bulgaria before the changes in 1990;

Bulgarian microelectronics specialists were doing the technological transfer to the other former COMECON countries. For this purpose, many of them were specialising in leading western universities and firms, which highly raised their professional level;

- restructuring and privatisation were done, appropriate for the sector;
- the main development unit of the Bulgarian microelectronics - the Institute of Microelectronics - not only did preserve its area of activities, but it also did manage to grow up technologically, together with its joint companies, and to fit within the requirements of the European market.

Main entities

At present, the microelectronics sector consists of the following main educational, scientific and production entities:

Universities

- Technical University - Sofia;
- Technical University - Gabrorvo
- Technical University - Varna
- Sofia St. Kliment Ohridski University;
- University of Chemical Engineering - Sofia
- Plovdiv Paisiy Hilendarski University;

Bulgarian Academy of Sciences

- Institute of Physics of the Solid
- Institute for Conduct and System Studies
- Institute of Applied Physics - Plovdiv
- Institute of Electronics

Companies

- Technological Centre-Institute of Microelectronics SPJSC;
- Hybrid Integral Circuits JSC;
- Sillway Semiconductors JSC;
- Hybrid Microelectronics JSC;
- Innovative Microsystems SPLtd.;
- BSS Ltd.
- EPIQ Electronic Assembly SPLtd.;
- Expect SPLtd.;
- Melexis - Bulgaria SPLtd.;
- Sky Gate JSC;
- Semkotech Engineering Ltd.
- Oimik SPLtd.;
- Autoelectronics, Plovdiv;
- Zigert Bul Ltd.;
- Asterics Electronic Ltd.;
- Konel Ltd.

- other micro and small-sized companies.

The companies from the sector have proved their capacity to generate innovations and to render export-oriented competitive high-tech production. They have stable positions in certain spots of the Western European market (Germany, Belgian, France, Sweden, Denmark, United Kingdom, etc.), as well as in the USA, Canada, Turkey, Yugoslavia. Some of the above companies, like "Technological Centre - Institute of Microelectronics" SPJSC, "Hybrid Microelectronics" JSC, and "BSS" Ltd., are considered as oriented to the domestic market, because their task is to provide scientific and information services to the sector, as well as services with technological development and with specialized staff training. Most of the companies have been certified according to ISO 9001. EPIQ Electronic Assembly SPLtd. is the first trade company in South Eastern Europe, which has been certified also according to QS 9000. Hybrid Integral Circuits JSC is in a process of certification according to QS 9000 as well.

The location of the trade companies of the sector, the percentage correlation of their production shares designated for the foreign and domestic market is given in the table, as well as the number of workers in each company as to 30 September 2000. These companies can be conditionally divided into the following groups:

Small and medium-sized export-oriented innovative companies:

- EPIQ Electronic Assembly SPLtd.;
- Sillway Semiconductors JSC;
- Hybrid Integral Circuits JSC;
- Innovative Microsystems SPLtd.;
- Expect SPLtd.;
- Melexis - Bulgaria SPLtd.;
- Sky Gate JSC;
- Semkotech Engineering Ltd.

The ownership of the above companies is the following:

Sillway Semiconductors JSC and Hybrid Integral Circuits JSC are joint companies of the Technological Centre - Institute for Microelectronics SPJSC, whereas French firms are partners to the first company, and Bulgarian firms are partners to the second. The rest of the companies of this group are 100 % foreign ownership (German, Belgian, Dutch and French capitals take part).

The following is to characterise the companies of this group:

- a relatively high annual earnings per employer - an average of 19 473 USD, and an individual share in the formation of the GDP many times higher than the average of the country;
- 100% of the production is being sold on the markets of Western Europe, the USA and Canada, except for Hybrid Integral Circuits JSC and Semiotech Engineering Ltd., which sell 95% of their production on the above markets and 5% - on the domestic market and in Turkey, and other East and Central European countries;
- considerable for the Bulgarian environment amount of investments - over 15 million USD only for the last 12 months;
- substantial innovative activity - over 130 original projects of integral circuits and 24 patents registered abroad annually (France, Belgium, USA, etc.);
- growing necessity for young specialists - over 40% of the staff of these companies are young specialists, with most of them started working during the last 24 months;
- active participation in supporting the education in the country by generating new staff.

The above mentioned information proves the importance of developing the Microelectronics sector for the global situation of Hi-Tech in Bulgaria. It is clear that the vitality of this sector is at a really good state and its further development would provide a favourable impact on the economy of the country.

Micro and small-sized innovative companies

- Technological Centre - Institute of Microelectronics SPJSC
- Hybrid Microelectronics JSC
- BSS Ltd.
- Asterics Electronic Ltd.
- Konel Ltd.
- other micro and small-sized companies.

The companies from this group serve for or are complementary to those from the first group. They provide a relatively high annual earnings per employer - an average amount of 14 432 USD, with a share of each individual in the formation of the GDP considerably higher than the country's average. Investments in this group are around 10 times less than those in the first group.

Technological Center - Institute of Microelectronics SPJSC, Hybrid Microelectronics JSC and BSS Ltd. provide scientific and information services, and specialized staff training to most of the other trade companies in the sector, as well as to foreign clients.

The rest of the companies from this group provide back-end microelectronics services.

Table 17 List of companies providing back-end microelectronics services

№	Company	Location	Markets in %		Staff
			foreign	home	
1.	Technological Centre - Institute of Microelectronic SPJSC	Sofia	10	90	58
2.	Sillway Semiconductors JSC	Sofia	100	-	234
2.1.	Sillway Semiconductors JSC, a separated section	Botevgrad	100	-	30
3.	Hybrid Integral Circuits JSC	Sofia	95	5	96
3.1.	Hybrid Integral Circuits, a separated section	Botevgrad	95	5	22
4.	Innovative Microsystems SPLtd.	Sofia	100	-	40
5.	Expect SPLtd	Sofia	100	-	150
6.	Melexis - Bulgaria SPLtd.	Sofia	100	-	70
7.	Semkotech Engineering SPLtd.	Sofia	95	5	25
8.	Konel Ltd	Botevgrad	60	40	12
9.	EPIQ Electronic Assembly Ltd	Botevgrad	100	-	546
10.	Autoelecronics	Plovdiv	90	10	120
11.	Asterics Electronic Ltd	Plovdiv	50	50	12
12.	Sky Gate JSC	Sofia	100	-	48
13.	Zigert Bul Ltd	Plovdiv	100	-	45
14.	Oimik SPLtd	Botevgrad	100	-	37
15.	Hybrid Microelectronics JSC	Sofia	10	90	8
15.1.	Hybrid Microelectronics JSC, separated section	Botevgrad	88	12	10
16.	Other micro and small-sized companies	Sofia, Plovdiv Botevgrad			25 5 5

Microelectronics companies in a no-good condition:

- Autoelectronics;
- Zigert Bul Ltd.;
- Oimik SPLtd..

The companies from this group are presently having serious problems concerning their ownership, relations between the owners, and their status (Zigert Bul Ltd. - 50% for both Zigert Germany and for Autoelectronics, and Autoelectronics - 50% Russian and that much Bulgarian state property, not registered under the Commercial Law), or they have unsettled relations with the Privatisation Agency (Oimik Ltd. - 100% Japanese property). As a result, these companies have been for years abandoned by their owners, with no investments, and in the same time they cannot be sold. Out of these companies, Autoelectronics is still in a very serious capacity for a good development in the branch.

Territorial distribution

As seen in the table above, the territorial distribution of the companies from the sector is in only three towns:

- 9 companies are Sofia-based;
- 3 of them operate in the town of Botevgrad, where there are also 3 separated departments of Sofia-based companies;
- 3 are in Plovdiv;
- other micro and small-sized companies in the three towns.

Out of the total 1598 people employed in the above companies, 754 work in Sofia (47,18%), 662 work in Botevgrad (41,43%), and 182 work in Plovdiv (11,39%).

The reason for this geographical distribution is that, before 1990, there were "clean rooms" established and active only in these towns, with the respective specialized infrastructure, and with well-trained microelectronics specialists. Some of these specialists became unemployed after the changes in Bulgaria, or got oriented to jobs that did not suit their qualification. Meanwhile, new microelectronics and high-tech staff is continually being educated by secondary and high-school education (The Technical University educates specialists in electronics and microelectronics in Sofia and Botevgrad.)

At present we witness the gradual launching of the production capacities in Botevgrad (purchased by Oimik SPLtd., Hybrid Integral Circuits JSC, Sillway Semiconductors JSC, Hybrid Microelectronics JSC, EPIQ Electronic Assembly SPLtd., and Technological Centre-Institute of Microelectronics SPJSC), as well as adopting of development plans of the mentioned companies. It would eventually result in a considerable increase in the number of high-tech specialists employed in those companies in the near future. Thus, the development of the companies in the sector will allow for the settlement of the serious social problem concerning the people with one of the most high-ranked qualifications. A great number of specialists from the town of Pravetz have also turned to the companies in Botevgrad.

Main activities and products

The main activities of the sector units are the following:

Projects of ASIC's and of integral sensors

The companies, enlisted below, design ASIC's and integral sensors for their own production as well as on the request from firms from Western Europe and the USA:

- Technological Centre-Institute of Microelectronics SPJSC;
- Hybrid Integral Circuits JSC;
- Sillway Semiconductors JSC;
- Hybrid Microelectronics JSC;
- Innovative Microsystems SPLtd.;
- Melexis - Bulgaria SPLtd.;
- Sky Gate JSC;
- Semkotech Engineering Ltd.

Front-end microelectronics activities

These activities include production of: silicon structures with integral circuits or integral sensors; thin and thick film hybrid integral structures and schemes; micro-modules and micro-systems, and silicon micro mechanics; and are carried out in:

- Hybrid Integral Circuits JSC (in Sofia and in Botevgrad);
- Hybrid Microelectronics JSC (a separate department in Botevgrad);
- Sillway Semiconductors JSC (in Sofia and in Botevgrad);
- Oimik SPLtd. (in Botevgrad);
- Autoelectronics (in Plovdiv);
- Konel Ltd. (in Botevgrad).

Back-end microelectronics activities

These activities include: building of integral circuits; measuring and diagnostics of integral structures and schemes, and of micro-modules and micro-systems; surface installation of elements on structures, including "bare" chips; programming of integral structures and schemes; electric thermal training and life-tests, a test for electromagnetic compatibility and other activities related to micro-electronic products, as well as to production of specialized installations and instrumental equipment to ensure implementation of the above activities.

The main companies in this group are:

- Technological Centre-Institute of Microelectronics SPJSC;
- Hybrid Integral Circuits JSC;
- Sillway Semiconductors JSC;
- Hybrid Microelectronics JSC;
- Innovative Microsystems SPLtd.;
- EPIQ Electronic Assembly SPLtd.;
- Expect SPLtd.;
- Melexis - Bulgaria SPLtd.;
- Sky Gate JSC;
- Semkotech Engineering Ltd.
- Oimik SPLtd.;
- Autoelectronics, Plovdiv;
- Zigert Bul Ltd.;
- Asterics Electronic Ltd.;
- Konel Ltd.
- other micro and small-sized companies.

Education and specialized training of staff

Preparation of specialists with a higher education in the sphere of microelectronics, and post-graduate qualification of staff are made mostly in:

- Technical University - Sofia, Department of Construction, Technology and Production of Semi-conductor and Microelectronic Elements, as well as in the Botevgrad branch;
- St. Kliment Ohridski Sofia University, Department of Physics of the Semi-conductor Appliances, Department of Physics of Solid and Microelectronics, and in the Institute of Physics and Techniques of the Semi-conductor Appliances;
- University of Chemical Engineering - Sofia, Semi-conductor Technologies Section;
- Gabrovo Technical University, Electronic Techniques Department;
- Varna Technical University, Electronics Department;
- Plovdiv Paisiy Hilendarski University;

- Technological Centre-Institute of Microelectronics SPJSC;
- Hybrid Integral Circuits JSC;
- BSS Ltd.;
- High School for High Technologies.

Within the specialised departments of microeconomics in the above universities, the education and the scientific research activities are carried out by 115 teachers and researchers, with 68 of them being professors and associate professors. Over 350 students are educated within the Microelectronics direction, with the average of around 70 graduates per year specialising in the field of designing of integral circuits and structures, microelectronics elements, specific application of microelectronics technologies and elements, etc. There are 20 Ph.D. students at present.

Within other specialised departments of the above universities, education in microelectronics is provided for students from other fields of education - Computer Sciences, Electronics, Francophone Department of Electric Engineering, English Language Department, etc.

The university teachers take active part also in international projects in the field of microelectronics. There is joint participation in European Union funded projects with the following European universities: ENSEA – Gerdy и INSA – Rennes /France/, TU – Ilmenau и TU – Dresden /Germany/, University of Manchester and University of Oxford /United Kingdom/, Technical University – Budapest /Hungary/, Salonika University /Greece/, etc.

Bulgarian university teachers in microelectronics have been invited as visiting lecturers in: University of Huston /USA/, Technical University, Vienna, TU – Ilmenau, Ensea – Gerdy, etc.

The necessary equipment appears as a serious problem in view of the quality of students' education. Unfortunately, over the last 10 years the above universities have not received financial support from Government and its structures. New necessary equipment has been purchased only by sources under international projects, predominantly from funding under contracts with trade companies from the microelectronics sector. It is important to mention that the extremely fast development of this sector demands provision of the students with the latest products of Hi-Tech industry and modern education equipment. These factors are of great importance for the quality of work and education of the present and future professionals in the sphere of microelectronics. The government should do their best to support the sector and encourage companies to provide funding for training and educational programs.

The microelectronics equipment in the **Technical University - Sofia** is relatively preserved, and their Department of Construction, Technology and Production of Semi-conductor and Microelectronics Elements have founded nine study laboratories and a scientific-research laboratory.

- Laboratory for Vacuum and High-Temperature Processes
- Laboratory for Photolithography and Photo Masks
- Laboratory for Thick film Technologies
- Laboratory for Control and Shaping of Technical Process in Microelectronics
- Laboratory for Surface Installation
- Laboratory for Installation and Hermetic Sealing
- Laboratory for Computer Simulation and Shaping
- Laboratory for Optic Control and Measuring
- Laboratory for Ultra High-frequency Measuring.

The technological laboratories of the Department use a unique equipment for photolithography, vacuum processes, high-temperature processes, chemical and electric-chemical equipment, specialized measuring equipment. The equipment in these laboratories enables the graduate and post-graduate students to acquire knowledge and practical skills with microelectronics technologies.

A Scientific-production Laboratory for Automated Designing in Electronics and Microelectronics /ECDD/ has been set up within the Department. It has a modern equipment and program systems at its disposal:

- 4 working SUN SPARC stations 10/40, 8 personal computers Pentium connected in a network;
- The program stations for designing are: CADENCE, SYNOPSYS, XILINX, ALTERA, DESIGN CENTER, EASY – PC, etc.

The laboratory is a regular member of EUROPRACTICE /N 04009/. In this way it has an access to producers of integral circuits, maintaining EUROPRACTICE, like ALKATEL, AMS, etc.

The Sofia St. Kliment Ohridski University has at its disposal a necessary equipment for photolithography processes, high-temperature processes, epitaxial growing of layers A and B, installation processes in microelectronics, X-ray analysis, designing of semi-conductor appliances, specific measuring equipment, etc.

The University of Chemical Engineering has at its disposal an equipment for spectrometric analysis of substances and materials, for precipitation of thin layers /vacuum-thermal manner through cathodic pollination and laser stimulation/, for a control over thin layers, for a synthesis of MHF-materials, etc.

In general, the necessary equipment in the universities is not at an up-to-date level, and its updating is urgent.

Specialized training of staff in microelectronics, and the post-graduate training of students, the so-called company training, are carried out mainly in:

- Hybrid Microelectronics JSC
- BSS Ltd.
- High School for High Technologies.

The High School for High Technologies is a joint school of the Technological Center-Institute of Microelectronics SPJSC and the Technical University - Sofia. It is governed by a specialized Scientific Council consisting of 12 academic-ranked persons.

The above-mentioned three units provide staff education on the request of the sector's trade companies, as well as on the order of foreign clients. The education includes training and interviews. As an important criterion for the quality of education in the above units and in the University comes the fact that, during the last couple of years, over 50 of their graduates have gone to work in leading world companies in the USA, the United Kingdom, Germany, France, Holland, Finland, etc., while very positive comments on their achievements have been received.

A favourable coincidence is the fact that leading professors at the Technical University and the Sofia University act also as heads of some of the sector's leading trade companies. This to a large extent relieves the relationship of the trade companies with the universities.

Scientific-research activities and development of technologies:

Scientific-research activities and development of technologies are implemented in each of the bigger trade companies like:

- Technological Centre-Institute of Microelectronics SPJSC;
- Hybrid Integral Circuits JSC;
- Sillway Semiconductors JSC;
- Hybrid Microelectronics JSC;
- Innovative Microsystems SPLtd.;
- Expect SPLtd.;

- Melexis - Bulgaria SPLtd.;
- Sky Gate JSC;
- Semkotech Engineering Ltd.

Teachers at the universities enlisted below also carry out scientific-research activities under contracts with trade companies in the sector:

- Technical University - Sofia
- St. Kliment Ohridski Sofia University
- University of Chemical Engineering - Sofia

Scientific surveys in microelectronics are also conducted in the Bulgarian Academy of Sciences:

- Institute of Physics of the Solid
- Institute for Conduct and System Studies
- Institute of Electronics
- National Centre for Nano Technologies
- other BAS units.

Following are the thematic fields of the surveys conducted:

- Micro-electronic sensors for magnetic fields, gases, temperature, light;
- Micro-electronic and optic-electronic technologies;
- Examination of microelectronics materials;
- Dissemination of achievements and the scientific prospects for the nano-sized phases in all the forms - training, schools, seminars, conferences and publishing.

The staffs of these institutes, working in the field of microelectronics, consist of highly-qualified scientists. They work on concrete projects for Bulgarian firms, as well as on international projects. However, the necessary equipment is out-of-date physically and morally.

A brief information on some of the front-end microelectronics companies

Sillway Semiconductors JSC has the main field of activities as follows: designing and production of CMOS, BiCMOS, HCMOS, and BCD integral circuits /IC/. Along with the standardized micro-electronic technologies with the norm of 1,2 μm, the company designs and produces sub-micron IS - in this case, the integral structures are produced in European factories, while designed, tested and built in Bulgaria.

The current monthly production capacity of the company numbers 3500 four-inch silicon plates with ready IC. The company disposes of four working “clean rooms”, three of them in the town of Blagoevgrad, with the total area of more than 5000 square meters.

In the year 2001, a new “clean room” will be set in operation in Sofia, with the area of 1500 square meters, thus enhancing the production capacity to 5000 silicon plates with ready IC per month, with a part of them being 6-inch sized.

The amount of the investments has been more than 4 million USD over the last year, including introduction of new technologies and methods of production. A number of patents have been registered /in France and in other Western European countries/.

More than 270 specialists have been employed in the company, with 90% of them having a higher education. During the last couple of years, more than 120 young specialists have been employed.

The company has purchased the factories for IC production in Botevgrad, together with the respective specialized infrastructure.

Hybrid Integral Circuits JSC has as a main area of activities the following: designing and production of thick and thin film hybrid integral circuits, micro-modules and micro-systems, and surface installation of electronic elements.

Over 95 % of the company's production is designated for Western markets. Under long-term contracts micro-systems and hybrid integral circuits are produced for NATO (for three of the European armies), for firms like Volvo, Danfos, General Hybrid, and many others.

About 120 specialists work in the company, with more than the half of them being young specialists.

The company has purchased and set in operation the factory for hybrid integral circuits, the new "clean room", and part of the building of the former Institute of Optic Electronics in Botevgrad. 22 specialists work in the section separated in Botevgrad, and after the reconstruction of the production capacities, another 100 specialists will be employed, with part of them already being trained under a contract with the Technical University.

Technological Center - Institute of Microelectronics SPJSC

In restructuring of the former Institute of Microelectronics /IME/, two requirements have been fulfilled:

- all activities of IME that had an acknowledged market, were transferred to newly-founded joint companies. IME takes part in these companies with long-lasting assets, know-how, and with well-trained specialists, while its partners participate with their markets and with a considerable amount of fresh investments;
- IME was transformed into a technological centre /park/ with the main task to provide services to its joint companies, to encourage and support the development of newly-founded and existing small and medium-sized companies in the sphere of high technologies, especially microelectronics, micro-systems, electronics, program support, and production in "clean rooms", as well as to carry out scientific and information activities.

At present, there are 29 trade companies successfully functioning in the high-tech sphere on the territory of TC - IME SPJSC in Sofia , and on the Botevgrad working ground. Many specialists, educated at the former Institute of Microelectronics in Sofia, took part in establishment of Expect SPLtd., Melexis SPLtd., Hybrid Integral Circuits JSC, Sillway Semiconductors JSC, Hybrid Microelectronics JSC, Innovative Microsystems SPLtd., BSS Ltd., Melexis - Bulgaria SPLtd., and Semkotech Engineering Ltd.

Weaknesses and threats to the sector

Companies from the sector, as well as universities that serve it, work under the same unfavourable conditions, as do the rest of the companies and high schools in the country.

There is lack of governmental support for scientific researches and for modernizing of education. Funds allocated from the state budget, albeit extremely insufficient, are enough only for salary payments to those working in the BAS and the state universities, and for some urgent expenses for electricity, heating, water, etc. Therefore in practice, for years, the government has not allocated funds at all for scientific research, technological development, and for improvement of education.

There is lack of governmental policy of support for innovative companies. In 1999, a National Strategy for High Technologies was adopted, but until now, nothing has been done to fulfill the State's and the government's obligations according to this strategy. Even more so, the High-tech Parks Law, after passing on the first reading, has more than a year remained at the National Assembly, and it will seemingly not be adopted until the end of this Parliament's mandate.

There is lack of governmental policy to set up favourable investment conditions in Bulgaria, and in particular, in the sphere of high technologies. Having in mind that our specialists have demonstrated their capacity and skills, and found themselves among the most acknowledged of their colleagues world-wide, more than strange is the lack of political will and willingness to establish a favourable environment for

investments, so that some of our specialists, the young ones in particular, can remain in Bulgaria. Thus, instead of taking part in increasing the GDP, and in helping with their shares the social insurance in this country, and in creating an export-oriented, competitive production, they feel forced to do this for other countries. Taking into account that Bulgaria, i.e. its tax payers, have secured serious funds for their education.

There is lack of a credit policy, etc.

Most companies operating in the sector are weak in financial resources compared to their competitors abroad. They also experience enormous troubles in realization of appropriate marketing strategies.

The employee outflow is becoming stronger and stronger. Lots of the young professionals use Bulgarian firms to gain experience and then leave the country to pursuit career abroad.

Existing environment and bureaucracy are very time and resources consuming for the companies, and they hinder the normal development of the enterprises. Thus the effect of one of the few advantages - lower payment for the highly qualified labor is somehow reduced by the poor organization and work environment.

The level of investments in the branch is quite low, and the Bulgarian companies have started to accrue delays in their technological development, which is in principle fatal. So far, the technological delay has been compensated by covering applications, in which the decisive part is building an intellect in the integral structures and schemes, and not using the latest technological achievements. But this will not last long.

Possible support for the companies in the sector will be the provisions in the draft High-tech Parks Law. The experience of the Technological Center - Institute of Microelectronics SPJSC as a technological park, assisting the highly-innovative companies on its territory, shows that this direction is right.

In spite of all above-mentioned problems hindering the development of the Microelectronics sector, it is clear that this sector of the economy of the country has enormous potential and the proper government policy would lead to really good results. This conclusion is also supported when analysing the positive sides of the sector:

Strengths and Opportunities for the sector

- Good traditions and highly qualified personnel.
- Establishment of competitive clusters.
- Creation and export of innovative products with higher share of value added.
- Attraction of foreign investment.
- Higher employment of young professionals.
- Support of the Bulgarian educational system

It is obvious that the Microelectronics sector makes no exception and its strengths match the traditionally good indices of the Bulgarian Hi-Tech industry. High qualification of the personnel and competitive products form an adequate base for further development and the country should do the necessary that these advantages be used in the proper way.

Conclusion

The trade companies from the sector have proved their capacity to generate innovations and to render export-oriented, competitive high-tech production. They have stable positions in certain spots of the market in Western Europe, the USA and Canada. The following is to characterise the companies of this group:

- a relatively high annual earnings per employer - an average of 19 473 USD, and each individual's share in the formation of the GDP many times higher than the average of the country;
- nearly 100% of their production is successfully sold on the markets in Western Europe, the USA and Canada;
- considerable for the Bulgarian environment amount of investments - over 15 million USD only for the last 12 months, despite the unfavourable investment climate in this country;
- substantial innovative activity - over 130 original projects of integral circuits and 24 patents registered abroad annually(France, Belgium, the USA, etc.);
- many young higher-educated specialists, having graduated over recent years, have been employed in the sector, and moreover, a substantial number of students are presently being trained on the request of the sector's companies.
- most of the problems in the sector will be settled with the adoption of the High-tech Parks Law, which urgently requires action on the part of the Ministry of Economy in favour of this adoption as soon as possible.

All stated above, and the indisputable fact that the new century will be that of development of the microelectronics in the direction of nano and bio-technologies, as well as the results achieved in Bulgaria show that the Government should render a serious support for the companies working in the sector and for the high schools educating the appropriate human resources.

Biotechnology

Prof. Ivan Ivanov, deputy director, Institute of Molecular Biology - Bulgarian Academy of Science

Introduction

This document presents a critical survey on the development and present state of biotechnology in Bulgaria. Although Bulgaria has old traditions in biotechnology, its modern stage of development was not smooth. Being a priority area for the Bulgarian economy until 1989 it has been totally ignored after 1990. This led to a drastic decline and a painful recovery after 1997.

Bulgaria has experience, facilities (although not quite modern), technologies and manpower for the following branches of biotechnology: fermentation and pharmaceutical biotechnology (antibiotics and other products of fermentation technology), enzyme technology, mineral biotechnology, genetic engineering (both plant and microbial). The most advanced among them are antibiotic industry and mineral biotechnology and the most promising is genetic engineering.

Bulgaria has a new system for education in biotechnology at the three university levels (bachelor, master and Ph.D.) as well as two colleges preparing biotechnology specialists. There are many research institutes and university departments currently working on many projects related with biotechnology.

Although biotechnology in Bulgaria has great potentials, it is underdeveloped in general because of the severe deficiency of funding.

Biotechnology: What is this?

The term "**biotechnology**" has been introduced about 20 years ago to replace the old terms "**industrial microbiology**", "**industrial enzymology**", "**technical biochemistry**", etc. The latter terms reflected industrial application of achievements of a limited number of biological branches (microbiology, enzymology, etc.), whereas the new term "biotechnology" reflects implementation in industry of the results of all branches of the modern biology (microbiology, enzymology, immunology, molecular biology, molecular genetics, cell biology, plant physiology and genetics, biophysics, etc.). Actually, this term appeared in the literature at the time of advent of genetic engineering and hybridoma technology, which became the most advanced areas of biotechnology.

The Old Bulgarian Traditions in Biotechnology

Bulgaria is a country with old traditions in the classical fermentation technologies like beer, wine and milk industries. It is an old but still preserved tradition for Bulgarians to make their own home-made wine and strong drinks.

Until 1947 more than 20 000 small Bulgarian private companies had produced and sold wine in Bulgaria and Europe. The first big wine company (wine cellar) has been founded in Suhindol in 1909. After nationalisation (1947) many big wine factories and plants have been built in Sofia, Pleven, Russe, Lyaskovetz, Targovishte, Preslav, Pavlikeni, Pomorie, Burgas, Sliven, Chirpan, Perushtica, Assenovgrad, etc. Grape collection and processing have been modernised and discontinuous fermentation was soon introduced. The yield of wine (related to grape) increased from 40-50% for the home-made wine to over 73% for the industrially produced one. Wine production was standardised and Bulgarian wines became well known to the world market. The most popular wine trade marks are Misket, Muskat, Cabernet, Mavrud, Gamza, Dimiat, Kadarka, etc.

Brewery is an old industry too. The first Beer Cartel was founded in Sofia in 1908. It included 7 beer factories in Sofia, Lom, Plovdiv and Shoumen. A new Cartel (called United Breweries) was founded in 1927 and including 12 beer factories.

One of the oldest Bulgarian fermentation products is the "sour milk" (incorrectly translated "yoghurt"). It is a unique milk product, different from the world known yoghurt. Unlike yoghurt, Bulgarian sour milk is made of two bacteria (*Lacobacillus bulgaricus* and *Streptomyces termophylus*) living in symbiosis. Each one of the two microorganisms produces different biologically active substances. Maintenance of this symbiosis requires a special milk composition. This unique composition is typical for the Balkan countries milk only. That is why it is not easy to organize a stable production of real sour milk in other countries rather than in the Balkans. The classical yoghurt is a monomicrobial product. Other traditional Bulgarian milk products (typical products of the enzyme technology) are the "white cheese" (incorrectly translated "feta cheese") and the "kashkaval" (yellow cheese).

The fist plant for manufacturing of antibiotics was built in Bulgaria (Razgrad) in 1952-1954 and the second one (in Peshtera) in 1959-1960. They both used to produce (until 1989) more than 25 different antibiotics and 80% of their production was exported. About the same time several pilot plants and plants for fodder yeast have been also opened.

The first industrial installation for underground bacterial leaching was opened at the mine "Vlaikov Vrach) in 1970.

In order to satisfy the needs of Bulgarian fermentation technology for technological improvements, new technologies and qualified human resources, many specialized research institutes and departments to the universities were founded between 1950 and 1960. Some of them were: Higher Institute for Food and Flavour Industry (Plovdiv), Research Institute of Wine Industry (Sofia), Research Institute of Wine Industry (Pleven), Research Institute of Brewery (Sofia), Research Institute of Milk Industry (Sofia), Research Institute for Antibiotics (Razgrad), Research Chemical-Pharmaceutical Institute (Sofia), etc.

Upsurge of Biotechnology in Bulgaria (1983-1989)

Biotechnology became a priority area for the economy of the former Eastern Block countries, including Bulgaria, after 1983. It was regulated by a special **Programme for Development of Biotechnology in Bulgaria**, which was controlled by the former State Committee for Science and Technology and the Central Committee of the ruling party. Hundreds of millions of dollars were invested during the above period to ensure development of biotechnology in the following areas:

- **Fermentation technology**
- **Pharmaceutical biotechnology**
- **Plant biotechnology**
- **Environmental biotechnology**
- **Research and development (R&D)**
- **Education**

Fermentation biotechnology (industrial scale) was developed in the two plants for antibiotics in Razgrad and Peshtera and in the plant for manufacturing of enzymes in Botevgrad. These three plants were renovated and expanded and many other small pilot-plants and semi-industrial laboratories were created for production of:

- antibiotics for human and veterinary medicine
- odder yeast and alga
- baker yeast
- pesticides
- citric acid
- itaconic acid
- gluconic acid
- lactic acid
- lyophilized *Lactobacillus bulgaricum*
- vinegar
- ethanol

- decstran
- others

Pharmaceutical biotechnology was based on the former pharmaceutical giant "Pharmachim" with its five main branches in Sofia, Razgrad, Peshtera, Stanke Dimitrov (now Dupnitza) and Troian. Besides Pharmachim, several small factories and pharmaceutical pilot-plants were founded for production of:

- specific proteins, enzymes and hormones
- vitamins
- vaccines and antiserum for human and veterinary medicine
- biostimulants
- biosensors
- others

Environmental biotechnology dealt with:

- water purification
- soil cleaning (bioremedation)
- leaching (biometallurgy)

The **R&D** of the Programme for Development of Biotechnology in Bulgaria was the most impressive one. Tenths of the existing Bulgarian universities and research institutes has been affiliated to this programme and many other new centers, institutes, departments, research laboratories and groups were founded all over the country to work on different fields of biotechnology. Although the R&D was spread over the all areas of biotechnology, a special priority was given to the genetic and cell engineering. Some of the new units created at that time and their affiliation to the programme are listed in the following table.

Table 18 List of units created in Bulgarian Biotechnology Sector

New Unit	Subordinated to	Affiliation to the Programme
National Center of Biotechnology, Sofia	State Committee of Science and Technology	To co-ordinate research and implementation of results obtained under the Programme
Research Center of Biotechnology, Sofia	National Center of Biotechnology	Research and manufacturing of own or licensed biotech products
Research Center for Biostimulants, Sofia	National Center of Biotechnology	Research and manufacturing of biostimulants of natural origin
Institute of Genetic Engineering, Kostinbrod	Agricultural Academy of Sciences	To conduct research in the field of plant genetic and cell engineering
Research Institute for Antibiotics, Razgrad	Pharmachim	R&D on antibiotics
Research Institute for Antibiotics, Peshtera	Pharmachim	To conduct research on antibiotics for veterinary medicine
Department of Genetic Engineering, Sofia	Instit. Mol. Biol. at Bulgarian Acad. Sci.	Research on recombinant DNA technology
Department of Hybridomas, Sofia	Institute of Immunology at Bulgarian Acad. Sci.	Research on monoclonal antibodies
Research Group of Plant Genetic Engineering,	University of Plovdiv, Faculty of Biology	Research on plant genetic engineering

Plovdiv		
Centre for Biotechnology, Sofia	University of Sofia, University of Chemical Technology and Metallurgy, Technical University	Education and research in biotechnology
Department of Biotechnology, Sofia	University of Chemical Technology and Metallurgy	Education and research in biotechnology
Department of Biotechnology, Plovdiv	Higher Institute of Food and Flavour Industry	Education and research in biotechnology
Department of Biotechniques, Sofia	Technical University	Education and research in biotechniques and biotechnological equipment

Millions of US dollars were supplied to the above organisations for equipment, consumables and staff training. More than 1500 different projects were subsidised by the Programme during 1984-1989 and tenths of original technologies were developed and patented in Bulgaria and abroad.

The Programme for Development of Biotechnology in Bulgaria aimed also to create a modern biotech park (called National Center for High Biotechnology) at Gorni Lozen (near Sofia). The NCHB was designed to combine both R&D and manufacturing of high biotech products and should accommodate 1500 employees. Due to financial reasons, the NCHB had never been built.

The **education** in biotechnology was organised at both graduate and postgraduate levels. In order to satisfy the foreseen needs of qualified personnel for the future years, a special **Center of Biotechnology** for education in biotechnology at MS level had been created as an interuniversity unit between the three universities: Sofia University (Faculty of Biology), University of Chemical Technology and Metallurgy (Sofia) and the Technical University (Sofia). A pilot programme was launched for the education in this center according to which the students were trained all together during the first three years. After that they were split into three streams for further (two year) education in one of the three partner universities. Finally, they had to defend a master thesis. A great number of theses were worked out in the institutes of Bulgarian Academy of Sciences such as the Institute of Molecular Biology, Institute of Microbiology, Institute of Immunology, etc. They also used to accommodate tenths of Ph.D. students and junior university teachers for postgraduate and post-doctoral training. Several hundreds of biotechnologists succeeded to obtain their MS and Ph.D. degrees during the years 1984 and 1990. Unfortunately, most of them remained jobless and therefore were constrained to leave the country.

Decline of Biotechnology in Bulgaria (1989-1997)

The products of Bulgarian biotechnology were designed for domestic use and the markets of the former Eastern Block countries. They did not satisfy the world accepted GMP requirements and therefore were not eligible for export to the western market. That is why the collapse of the former Socialistic Camp and the Soviet Union in particular had a crucial effect on Bulgarian biotechnology. The latter was stricken also by the sharp transition from a state controlled to free market economy. The lack of market had a catastrophic effect on the Bulgarian biotech enterprises.

The most significant changes happened to biotechnology in Bulgaria after 1989 were the following:

- The State Committee of Science and Technology, National Centre of Biotechnology, educational Center of Biotechnology, etc., were immediately closed and biotechnology had not longer been a priority area for Bulgarian economy.
- A great number of small enterprises collapsed and the biggest (the antibiotic plants in Razgrad and Peshtera, the plant for enzymes in Botevgrad, etc.) restricted their activity to the state of survival.
- Many research institutes and universities had either stopped or drastically reduced their R&D activity.
- Hundreds of specialists (MS and Ph.D.) trained in biotechnology remained unemployed and left the country.
- Expensive equipment designed for research and industrial purposes had been abandoned and was either stolen or severely damaged.

The apocalyptic stage and agony for Bulgarian biotechnology was additionally extended until recently because of the slow privatisation and unstable economy.

Revival of Biotechnology in Bulgaria (1997-2000)

Economical conditions in Bulgaria were gradually improving during the last few years, which favoured the development of Bulgarian biotechnology. Some of the old biotech enterprises re-initiated their activities on credits and others were privatised and re-established as new companies. The R&D in universities and research institutes was re-activated on account of foreign grants and international research programmes. Educational system was reorganised to fit the western standards and the education in biotechnology was re-established in several universities, although in different forms (see below).

Pharmaceutical and Fermentation Biotechnology

Following 1989 the former pharmaceutical company Pharmachim has been split into several independent companies. They all were privatised and some of them were reunited under the new-born holding "**Balkanpharma**". Biotech products are presently manufactured by the company "**Balkanpharma-Razgrad**" (the former antibiotic plant in Razgrad). Its present product list is much shorter than before and includes two categories of products: 1) Substances and 2) Pharmaceutical formulations.

The list of substances includes:

- **Tilosin**
- **Apramycin**
- **Tobramycin**
- **Sulbactam**

The list of final (ready-made) pharmaceuticals consists of **93 items** (not presented here) which are based on both own substances and imported antibiotics.

Presently Balkanpharma-Razgrad employs 20-30% of its technological capacity. Most of the old technologies are now frozen because of necessity of technical renovation and technological improvements to satisfy the GMP requirements.

The R&D activity at Balkanpharma-Razgrad is carried out in the Research Institute for Antibiotics (belonging to the same company). It is focused on the development of new technologies for production antibiotics and new final forms.

"**Biovet"** is an independent private company based on the former branch of Pharmachim in Peshtera. It is specialised in manufacturing pharmaceuticals and other products for veterinary and farming. The product list of Biovet includes a great number of final forms classified into the following five categories of products:

- ***Tylosin* products***: Tylovet T (tylosin tartarate), Tylovet P (tulosin phosphate), Tylovet P (tylosine base), Tylovet 10% and 25% (injection form of tylosin), Tylovet pulvis, Tylovet forte (tylosin plus bromhexin), Bromhexotylosin for poultry, Bromhexotylosin for pigs, etc.
- ***Antiparasitic preparations***: Bulmectin (containing abamectin), Pandex (ivermectin), Abantel, Prazimec C and D, etc.
- ***Anticoccidials***: Salinopharm (salinomycin), Monensin, Yumamycin (maduramycin).
- ***Nutritional food additives***: Pharmastim (flavophospholipol), VAM-F for pigs (flavophospholipol, vitamins and minerals), VAM-F for poultry, VAM-F for calves and lambs, VAC-22F, etc.
- ***Dietary supplements***: Biomix for pigs, for fish, for poultry and rabbits, for horses, for sheep and lambs, for calves and cows, Vitamin C 10% (injection), Enterosan (*Lactobacillus bulgaricus & Lactobacillus LAB8*).

The R&D at Biovet is carried out in its well equipped research laboratories which are specialized in the following areas:

- Chemistry
- Microbiology & Biochemistry
- Analysis
- Final forms

The production facilities of Biovet are GMP certified and its products comply with the European and British Pharmacopoeia standards.

"**DeoDan**" is a small private company organized on the basis of the former Research Institute for Anticancer Antibiotics in Sofia. Its activity includes development and manufacturing of:

- ***Biologically active substances and components***
- ***Final Products on their basis***
- ***Pharmaceuticals for human medicine and veterinary***
- ***Dietetics***
- ***Cosmetics***
- ***Health food products***

Most of the DeoDan products are based on extracts and derivatives of the bacterium *Lactobacillus bulgarius* and on their own (patented) strain *Lactobacillus tumoronecroticance B51*. The most popular of the DeoDan products are:

- Deodan for. i.v. application (a preparation with tumor narcotising activity)
- Deodan cream (for skin burns, slowly closing wounds and varicose ulcers, cicatrices after burns and injures)
- Night and day cosmetic creams, milks and lotions
- Anti-acne cream
- Gastropharm (for treatment gastritis and ulcers)
- Normoflor (for intestinal flora normalisation after extensive antibiotic treatment)
- Yoghurt (prepared with the strain *Lactobacillus tumoronecroticance B51*)
- Ice cream from soy yoghurt (prepared with the above strain)
- Solacta (a dietetic drink based on fermented soy milk)

"**National Center for Infectious and Parasitic Diseases"** (NCIPD) in Sofia owns research laboratories and a pilot plant for production of the following products for human application:

- vaccines
- antisera
- blood products

Most of the NCIPD products are designed for the domestic market.

"**Plastchim**" is a private company based on the former plant for enzyme preparations in Botevgrad. Its product list includes the following products:

- **Enzymes**
  - Amylases (from *Bacillus subtilis, Aspergillus orizae* and *Aspergillus niger*)
  - Proteinases (alkaline proteinase from *Bacillus subtilis*, neutral proteinase from *Bacillus mesentericus*, acid proteinase from *Aspergillus niger*)
  - Cellulases (Xilanase from *Aspergillus niger*, Cease from *T. viridae*)
  - Pectinases (from *Aspergillus niger*, macerase from *Aspergillus niger*)
  - Lipases (from *Rhizopus arrhizus*)
  - Oxyreductases (lipooxigenase from *Penecillium sp.*)
- **Enzyme complexes**
  - Pivosin (for brewery)
  - Aprozyme (for textile, leather and detergent industry)
  - Protisine (food additive for calves and cows)
  - Stabilin (for the wine industry)
  - Celuten (for textile and washing)
  - Avapan (bread additives)
- **Bioactive substances for human and veterinary medicine**
  - Gastropharm (for treatment of gastritis and ulcer)
  - Normoflor (for treatment of colitis, diarrhea, proctitis, etc.)
  - Biolact 65 (biostimulant enhancing recovery of sportsmen)
  - Vitasan P (prophylactic of arteriosclerosis)
  - Faringolact (for treatment of tonsillitis, laryngitis, etc.)
  - Hepatosan (for treatment of liver diseases)

Plastchim does not have GMP conditions and its products are addressed to the domestic market and as well to the markets of some former Eastern Block countries.

Mineral and Environmental Biotechnology

Mineral and Environmental Biotechnology deals with bacterial leaching of heavy metals (copper, gold, uranium, etc.) from poor ores, microbial removal of certain undesired compounds from ores and minerals, bioremedation (water and soil cleaning by microbiological methods), production of petrol products from poor sources, gas production from farm dumps (biogas), etc.

The following plants and pilot plants are (or have been) functioning for:

- ***Bacterial leaching*** of **copper** from poor or unbalanced ores: "Tzar Assen" (Panagyurski Medni Mini), "Assarel" (Stara Planina), "Medet" (Panagyurishte).
- ***Underground bacterial leaching***: Two industrial installations (the biggest in Europe) have been functioning between 1970-1999 at the mine "Vlaikov Vrah".
- ***Bacterial leaching*** of **uranium**:
  - One industrial installation at Simitly (1985-1990)
  - One pilot plant in Momino

- ***Bacterial leaching*** of **gold:** Two pilot plants (1995-1998) at Panagyurski Medni Mini.
- ***Production of petrol products***: One pilot plant (1995-1998) at Tyulenovo.
- ***Bioremedation***:
  - For cleaning of industrial waste water: One industrial installation (1988-1999) at Tyulenovo and Dolni Dabnik and one pilot plant at Burgaski Medni Mini for cleaning of waste water from the mining industry.
  - One installation for purification of water contaminated by ammonium
- ***Removal of iron*** from quartz sand and kaolin: one pilot plant (1984-1987) at the Senovo mines.
- ***Bioconversion of waste materials*** from the mining industry: One pilot plant at Panagyurishte.
- ***Water cleaning***: many modern water plants supplying drinking water to the big cities.

Genetic Engineering

The only one Bulgarian company dedicated to the application of recombinant DNA technology is "**Pharmagen**". It is a small private company owing patents (including European), bacterial strains and know-how for production of recombinant human interferons alpha 1 (hIFN-α1) and gamma (hIFN-γ) as well as of several pharmaceuticals based on the hIFN-γ. The Pharmagen product list includes the following final forms:

- Gammaferon inj. (injection form of gamma interferon)
- Gammaferon eye drops (for treatment of viral eye diseases)
- Virogel G (gel for treatment of viral skin diseases)
- Ribovasan (gel for treatment of skin burns and slowly closing wounds)

Although these preparations have shown excellent results in clinics and are allowed for sale in Bulgaria, they are not on the shelves because Pharmagen does not have any industrial capacity and needs partners and investors.

R&D in the Field of Biotechnology

The R&D in biotechnology in Bulgaria is carried out in the following research institutions listed in the table below.

Table 19List of organisations performing R&D in biotechnology

Biotechnology field	Institution	Subject
Fermentation, enzyme and pharmaceutical biotechnology	Higher Institute for Food Flavour Industry (Plovdiv)	Research related with wine and beer production; selection of new yeast strains with improved technological characteristics; identification of new antibiotics; selection of *Streptomyces* strains having improved productivity of antibiotics; development of new technologies for production of amino-acids, vitamins and food additives; research on *Lactobacillus bulgaricus;* research on enzymes related with milk, bread and other products.
	Research Institute for Antibiotics (Razgrad)	Selection of antibiotic producers with improved productivity and technol-ogical advantages; improvement of technologies for fermentation of *Streptomyces* and purification of antibiotics.

	Research Institute for Wine Industry (Sofia)	Development of new approaches for stabilisation of wines and new methods for analysis; development of technologies for isolation of biologically active substances from wine waste materials (seeds and peels)
	Institute of Microbiology (at the Bulgarian Acad, Sci.)	Selection of bacterial strains for production of organic and essential aminoacids; research on proteolytic enzymes.
	Department of Biotechnol. (at the University of Chem. Technology, Sofia)	Biosensors; immobilisation of enzymes (enzyme bioreactors); bioconversion of farm dump materials (biogas production).
Mineral and environmental biotechnology	Department of Engineering Geoecology	Bacterial leaching of heavy metals from poor ores; removal of heavy metals from ores and minerals; purification of waste waters to drinking water quality; microbial removal of H_2S from natural gas; detoxification of agricultural lands polluted by heavy metals; microbial cleaning of oil polluted soils.
Genetic engineering	Institute of Molecular Biology (Bulg. Acad. Sci.)	Construction of recombinant bacteria for production of biologically active proteins for medical use (interferons, calcitonin, antiviral proteins, etc.); research on improvement of gene expression; stabilisation of bacterial plasmids; structure-function relationship studies; development of technologies for purification of recombinant products and new pharmaceuticals.
	Institute of Genetic Engineering (Kostinbrod)	Laboratory and field tests with transgenic plants (tobacco, potato, etc.) created by Monsanto, Astra Zeneca, etc.; transformation of vine and other plants with specific genes.
	Department of Plant Physiology, Faculty of Biology (University of Plovdiv)	Expression of foreign genes in cultivated plants (tobacco, maze, etc.).
Biotechniques	Department of Biotechniques (Technical University, Sofia)	Biosensors for registration and quantitative analysis of certain biologically active and important substances

Education in Biotechnology

Reorganization of Bulgarian educational system has started several years ago in order to introduce a **three level university system** ending up with **BS** (bachelor), **MS** (master) and **Ph.D.** respectively. The three university degrees in biotechnology can be obtained in several state universities (see below). The BS degree was introduced several years ago after a joint Tempus project (entitled "***National Curricula and Study Programmes for Bachelor Degree in Biotechnology***") had been run within three Bulgarian universities (University of Chemical Technology and Metallurgy, Higher Institute for Food and Flavour Industry in Plovdiv and the University of Plovdiv**)**, the Institute of Molecular Biology and four European universities. Bulgarian institutions presently preparing specialists in the field of Biotechnology are the following:

- ***Sofia University*** (Faculty of Biology): Annual enrollment - 30 students. Until now all students graduated with a MS degree (following the old one level system). Since 2001 they will end up with a BS degree and about 20% of them are expected to join the next MS and/or Ph.D. programmes.
- ***University of Chemical Technology and Metallurgy*** in Sofia (Department of Biotechnology): Annual enrolment - 25 students. Their status is as above.
- ***Higher Institute for Food and Flavour Industry*** in Plovdiv (Department of Biotechnology): Annual enrolment - 35 students. Their status is as above.
- ***University of Mining and Geology*** (Department of Engineering Geoecology): Prepares few MS and several Ph.D. students in the field of mineral and environmental biotechnology.
- ***Plovdiv University*** (Faculty of Biology): Prepares several MS and Ph.D. students in the field of plant genetic engineering.
- ***Institute of Molecular Biology*** (Bulgarian Academy of Sciences): Prepares Ph.D. students in bacterial and pharmaceutical genetic engineering.
- ***Institute of Microbiology*** (Bulgarian Academy of Sciences): Prepares Ph.D. students in fermentation biotechnology.

There are also two colleges preparing technicians for the needs of Bulgarian biotechnology:

- ***College for Biotechnology*** (at the University of Chemical Technology and Metallurgy in Sofia): Annual enrollment - 20 students.
- ***College for Biotechnology*** in Razgrad (at the University of Russe): Annual enrollment - 20 students.

Besides the above specialists, Bulgarian biotechnology relies also on chemists, biologists, food technologists, pharmacists, etc., graduated from one of the above or other Bulgarian universities.

Intellectual Property and Legislation Related with Biosafety

Since 1993 Bulgaria has a new intellectual property law and a new patent system. It replaced the former "Certificate for Invention" system and is closer to the European rather than to the American patent system. During this transition a great number of inventions in biotechnology have not been converted into patents and therefore are not valid anymore. The reasons for this were the financial inability of inventors to maintain their own patents and the dramatic decline of biotechnology at that time and therefore the lack of interest on the side of enterprises towards technological innovations.

In 1994 a Biosafety Committee was created in Bulgaria to elaborate rules and precaution measures for applying genetic engineering methods and use of genetically modified organisms (GMOs) in Bulgaria. In February 1995 the Ministry of Agriculture has established a Council to control the use of GMOs. This year (2000) a draft of a Law for GMOs is worked out and presented to the Parliament. It is similar to the laws of other European countries and concerns the rules, licensing and sanctions related to the use and release of GMOs. It is anticipated that the Law for GMOs will be accepted next year.

Classical Technologies Related to Biotechnology

As already mentioned, Bulgaria has old traditions in some classical technologies related to biotechnology and they were among the first showing a remarkable progress in the time of free market economy. Most promising of them are the following:

- Wine industry
- Brewery
- Meat processing industry
- Milk processing industry
- Grain processing industry
- Essential oil and fragrance industry
- Pharmaceutical industry based on natural products

Their survey is beyond the scope of the present overview and they should be reviewed separately.

Conclusions

The present survey clearly showed that Bulgarian biotechnology is now in a stage of slow recovery. This process proceeds most successfully in the field of fermentation biotechnology dedicated to manufacturing of antibiotics and other pharmaceuticals, which is one of the first privatised industries in the country. The other areas of biotechnology are still lagging behind because of the lack of booster funds. The next branch, which is expected to be recovered soon after privatisation, is the mineral biotechnology. All technologies applied so far in this field (bacterial leaching of rare and expensive elements) have been developed at the University of Mining and Geology and are well known abroad. Some of them have been bought and successfully applied in other countries (like Brazil).

A promising field of biotechnology seems to be the genetic engineering of biologically active substances for medical use. Taking into consideration that these substances (most of which are hormones, immunomodulants, growth factors and regulators, etc.) are endowed with high biological activity, their manufacturing require modern pilot plants rather than real big plants. They are profitable since they itself, as well as their final (ready for use) forms are still quite a bit expensive. The world market for this category of products is estimated to be several hundreds of billions of US dollars for the next few years. Genetic engineering, however, requires educated and highly qualified people. As already mentioned, such specialists are presently available in the country and are continuously preparing at the Bulgarian universities and research institutes. A key consideration in favour of developing such a high biotechnology in Bulgaria is the low price of the qualified labour and the cheap clinical trials in the country. According to the forecasts this situation will remain almost unchanged during the next few years.

Automation

PhD Benislav Vanev, vice chairman, Union on Automation and Informatics

Automation – importance, goals, tasks

Automation is the process of substituting human functions in the management of different projects with technical and software means and systems. The management of projects (industrial, economic, logistic, financial, etc.) is related to receiving, transmitting, processing and using of information for the purpose of achieving the management goals. Therefore, automation is an important constituent of the overall technological and economic development. It penetrates and implants into each area, both into the research process and the production and the sale processes. The use of different technologies (nuclear, biotechnology, microelectronics, etc.) is possible only through highly automated equipment. Automation takes the role of a system integrator between the technological project and the elements of the automation system (technical means and devices – hardware, programming means - software and engineering activity – arguer).

The evolution of automation introduces new relations between labour and capital costs within the production functions; it is also closely related with employment, quality, prices, markets, competitiveness and other economic factors, thus turning from a technical problem into a factor affecting all aspects of the technological, economic and social development.

However, our goal is not to cover all aspects and applications of automation, but rather focus this sector analysis on the automation of the industrial sector. The automation of the processes in the service sector is often interpreted as processing of business information through modern computer technologies and software, which are discussed in the analyses of the microelectronics and software sectors.

Industrial automation treats different technological and production processes (continuous, discreet, separate), carried out by all economic sectors. Automation is related with the use of various technical and software means and devices on one hand and with the development and the finalization of automation systems on the other.

The production of technical means and devices is subject to a separate production area (sector), whereas the building of automation systems is a typical engineering activity, which includes design, finalization, procurement, assembly, servicing and training. Therefore, we have divided this analysis into two major chapters:

- Automation means and devices;
- Systems for industrial automation.

It should be immediately noted that production and engineering activities are interrelated and interdependent and should be analyzed together due to many common issues (human resources, markets, co-operation, etc.).

The implementation of automation activities has the following tasks:

- Improvement of the production management;
- Improvement of quality;
- Increase in the output volume;
- Raw materials and energy savings;
- Labour savings;
- Improvement of equipment security and efficiency, elimination of the harmful, exhausting and boring physical work, alleviation of intellectual work and improving its efficiency.

The achievement of these tasks to a large extend determines the productivity of the company (enterprise) or industry (sector), i.e. their competitiveness. Therefore, automation is a topical issue for all management levels in the economy.

Automation means and devices

Demand. Characteristics of the Bulgarian market.

The companies working under continuous technological processes (food industry, energy, chemical industry, metallurgy, etc.) are the major users of automation means and devices. The companies use them for replacement and reconstruction, as well as for building of new systems. There is also a demand for the construction of new projects and enterprises and for completing a full set of machinery and equipment. The parameters, which are subject to regulation are temperature, pressure, levels, costs, etc. (see table below, based on statistical data)

Table 20 Relative share of measured parameters in the automation of continuous technological processes (%)

Parameter	Relative share against:	
	Measurement points	Costs
Temperature	45,0	5,0
Pressure	25,0	13,0
Cost	13,0	34,0
Level	10,0	12,0
Moisture	0,3	0,1
Viscosity	0,2	2,5
Rotation frequency	12,0	0,2
Analytical devices	3,0	32,0
Others	1,5	1,2
Total	100,0	100,0

Source: Statistical data

According to the above table, the technical means and devices for regulation and measurement of temperature have the largest share (as per product range), but due to their relatively plain design they have a small share in the overall costs for building of automation systems. These tools are produced with little value added and are considered "low cost automation". The analytical devices take on a significant know-how (nearly 30% of costs).

The following table presents the experts' opinion on the demand for major types of automation means and devices.

Table 21 Major types of automation means and devices for enterprises working under continuous technological process

Automation means and devices	Relative share in total costs
Means and devices for receiving information (sensors, transformers, measuring devices)	40,0
Means and devices for transforming, storing and processing of information (regulators, computer installations, monitoring devices, industrial computers, visualization tools, etc.)	30,0
Means and devices for using of information (implementation and regulation agencies)	15,0
Supporting elements (feeders, control boards, panels, cables)	15,0

Source: Statistical data

The above figures are average and their exact values vary in accordance with the functions and the structure of the automation system to which they belong.

There is a relatively less demand in volume and product range from enterprises having discreet production processes (machine building, light industry, etc.), where the automation of production is accomplished mainly through highly automated machines and production lines, robot-based systems, flexible automation systems, etc.

The industries, which suffered most from the overall decrease in production in Bulgaria after 1990 were the chemical industry, black metallurgy and others, and this had an adverse impact on the demand for technical means and devices on the Bulgarian market. Demand decreased significantly and together with the loss of several traditional foreign markets had a crucial impact on production. The enterprises within the former economic entity "Priborostroene" in Rousse, Koprivshtitsa, Petrich, Montana, Knezha, etc. also cut their production. Thus, the total production volume of automation means and devices as at 1992 fell almost three times and continued this trend in the following few years (see table below).

Table 22Total production volume of automation means and devices, indices

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Index	100	58	36	38	37	30	31	19	18	28

Source: National Statistical Institute

1999 reported increase in production due to the overall output growth in several sectors. One of the largest users of automation means and devices is the energy sector, especially for replacement and reconstruction of existing capacities and for building of new ones.

All projects for environmental protection, incl. projects related with energy savings, suggest an increase in the demand for means and devices for measuring, control and regulation of heat and electricity, incl. gas, water and other resources.

According to experts' estimates the current volume on the local market amounts to USD 10 –12 million and it is not expected to increase in the next few years, despite the positive trends (the annual production of the sector on the world markets increased by 20%).

There are no serious prospects for export growth, because almost every industrial country is producing such means and devices, thus satisfying the largest part of its demand. Better opportunities can be seen for the export of machines, production lines and finalized projects, where automation means and devices should be built into.

Producers of technical means and devices

The Catalogue of Bulgarian companies[*] includes over 30 Bulgarian companies – producers and importers of technical means and devices. These are mainly small-scale private companies, having up to 50 employees. The largest companies are listed in **Error! Reference source not found.**. Amongst these - DELTA INSTRUMENT, UNISIST, KOMEKO, etc. have serious presence on the local market. Nearly half of all producers are located in Sofia and the rest are situated in most of the large industrial cities – Plovdiv, Rousse, Pleven, Stara Zagora.

Alongside, there are many foreign leading companies in the production of technical means, which have representation offices in Bulgaria: Siemens, Festo, Honeywell, Hartman and Brown, Fisher – Porter, Schneider, Brown Boveri, etc. This increases the market competitiveness.

[*] Electronics, automation, electrical appliances – Bulgarian companies' catalogue

Products

Further to the aforesaid demand the main product range includes a variety of measuring devices for major technological indicators – temperature, pressure – level and costs, industrial regulators, pitching controllers, executive mechanisms and other specific technical means and supplementary tools (feeders**,** control boards, panels, cables, etc.)

The produced means and devices are tested in accredited laboratories for functional specifications, electricity safety, etc., but do not pass the tests required under the European standards – e.g. electromagnet compatibility.

The leaders in the sector (DELTA INSTRUMENT, UNISIST, KOMEKO, etc.) are certified under ISO 9000.

The technical specifications of the produced means and devices comply with the basic requirements of the European consumers. There is no technical design and production of means and devices, based on new physical principals and modern technologies, such as measuring devices with enhanced intelligence; measuring tools for compound parameters, etc. Alongside with the Bulgarian producers there are also foreign companies, which use such devices for the finalization of their own automation systems.

Besides from production, most companies often import equipment from European and world leaders, such as SIEMENS, IMT, SENSORAT –GERMANY, SENSOTECH – USA, WAF – NETHERLANDS, ETC. Many Bulgarian producers have the exclusive rights to represent or distribute the products of such companies in Bulgaria.

Only few producers (DELTA INSTRUMENT, KOMECO) export part of their production to countries, such as Spain, Portugal, Romania, Ukraine, Macedonia, etc.

Production

Producers dispose of depreciated low-effective equipment used for small production series. Many technological phases within the production process (production of printing plates, mechanical elements, backing, painting, etc.) are consolidated with other companies. However, the testing equipment is insufficient.

A positive step in this direction is the factory of the DANFOS company for measuring thermal devices and the EPIQ company in Blagoevgrad for sensors and automobile electronics, etc., both of them built up by foreign investors.

The labour productivity (approx. BGN 30,000 per head p.a.) is nearly 10 times lower than the European countries. This determines the low competitiveness in the sector.

Innovation potential. Technological and market strategies.

The innovation potential of the sector can be evaluated by means of 4 major factors: human resources, know-how, inventory and financing[21].

- Human resources

All companies dispose of highly qualified specialists. Some of the companies have been established by lecturers from technical universities, research associates from research centres for automation and technical design, as well as from the Bulgarian Academy of Science (BAS) e.g. Delta Instrument, Unisyst, Komeko, etc.). However, there is a shortage of qualified specialists in marketing and trade.

[21] J. Hentze, P. Brose; Unternehmungsplanung, Verlag Paul Haupt, Bern und Stutgart, 1991

- Know-how

The existing know-how is related with the individual specialists. There have been no registered patents, nor licenses bought. This led to the production of conventional technical means and devices, which do not differ from those of the competition and their sales do not take on significant value added.

- Inventory

Companies are not furnished with modern equipment for research and development.

- Financing

Companies do not have sufficient funds to finance research and development activities and to purchase licenses.

Companies in the sector rely on a "low-cost" market strategy as a result from the relatively low remuneration, quick delivery and good service.

Within the next 2-3 years the competitiveness of the companies is not expected to increase in parallel with production growth due to the volatility of the market and the high risk associated with potential investments.

The technological strategy[*], [**] for product development can be described as "catching up with" due to the lack of researches in this field and the lack of adequate infrastructure allowing for product differentiation.

A more successful strategy will be to search for technological niches (focal point) within different industries, where we have competitive advantages (biotechnology, Greenfield engineering, environmental protection), due to more advanced "clusters" and international co-operation.

Overall assessment of the sector

Strengths

- There are viable small- and medium-scale private companies, which produce comparatively wide range of good quality automation means and devices.
- Representation offices of leading foreign producers of automation means, devices and systems are working in Bulgaria. This classifies the Bulgarian market as an open market with high level of competitiveness.
- The overall decrease in production has been captured and in 1999 the volume of produced automation means and devices has increased.
- There are qualified specialists with high and secondary vocational education, working in the sector. The educational system in this field is good.
- There are associated production processes (manufacturing of printing plates, capacities for mechanical processing of metal and plastic, etc.), that co-operate with the producers of automation means and devices, thus increasing their production capacity, flexibility and speed.
- Some of the companies are located at technological centers and parks, which has a positive impact on their activity.
- Companies have plenty of information, they're leaders in applying computer technology into the design and management processes, and are Internet-based

[22] Todorov K.: Startegic management in small- and medium-scale companies.
Published by "NEXT", Sofia, 1997
[23] Baier, W., F. Pleschak, Marketing und Finanzeirung junger Technologieunternehmen Gabler, 1996

Weaknesses

- The sector can be described as lacking good productivity and competitiveness.
- Bulgarian companies operate with "low value" products and production technologies. There are no big differences between their products and those of the competition and there is no value added.
- There are no applied researches, nor licenses bought, therefore it is hard to introduce new technical specifications into automation means and devices.
- The production of the Bulgarian companies is sold mainly on the local market, which is quite limited and cannot guarantee for optimum production scales.
- Companies manufacture small volumes and do not apply modern technologies for research, production and testing. There are no investments in technology, which will allow for optimum production volume.

Threats

- The "low cost" strategy may work for another few years. However, in the long run the low remuneration cannot be treated as a competitive advantage, especially in this technological field. If the leading companies do not change the strategy, this will lead to the inevitable liquidation of companies, especially given their size.
- In case no laboratories for testing of product quality are built up in due time (esp. for electromagnet compatibility), the automation means and devices manufactured in Bulgaria will lose their competitiveness on the European market.
- The shrink in production volume and the size of the companies will hamper the reproduction of qualified specialists in this field.

Opportunities

- The anticipated increase in energy generation and services, public heat-, electricity- and water supply, tourism, environmental protection, food industry, machine building, export growth in machine components and finalized projects and the introduction of infrastructure projects, will expand the market for automation means, devices and systems.
- The development and the financing of national inter-sector projects may encourage research, development and production of certain high-value automation means and devices, which will be used by biotechnology, environmental protection, health and other technological sectors.
- The establishment of a network of technological incubation centers will invigorate the creation of new companies in the sector and will help determine local and regional demand.

Systems for industrial automation

Users. Characteristics of the Bulgarian market.

Users of automation systems are all manufacturing industries and the expenses on those systems represent a substantial part of the total investments in the sector (see table).

Figure 15 Automation expenses in different economic sectors

Sector	Relative share in total investments %
Chemical sector (incl. petrochemical industry)	25,0
Energy	20,0
Metallurgy (black, ferrous)	17,0
Cement industry	15,0
Cellulose and paper industry	15,0
Light industry	10,0
Food industry	10,0
Glass industry	15,0

Source: Statistical data

As seen from the above table the largest share of automation expenses belongs to chemical industry, metallurgy and energy sector, where the main technological processes cannot be carried out without automation systems. In those, as well as in other sectors, which are working under continuous technological processes, the operations of the automation systems can be structured into three major phases according to the goals:

Ist phase – management of individual processes, machines and equipment;

IInd phase – operational production management, co-ordination, optimization (SCADA systems);

IIIrd phase – management of the entire company (planning, financial performance, human resources, procurement, product sales).

The reduction in the output volume and the lack of sufficient investment funds (incl. foreign investments) has substantially compressed the Bulgarian market for industrial automation systems.

At this time the largest demand in automation systems can be seen in the energy sector, which sustains its development trends and enjoys huge investments due to a number of reasons. The cement plants and some chemical plants (Solvey Sodi – Devnya), etc. are undergoing a restructuring process.

The anticipated investment growth will be closely related to increased demand for automation systems.

Automation for machine-building enterprises is effected through implementation of highly automated machines and production lines, flexible production systems, robot-based segments, etc. Due to the lack of competitive products and markets, output volumes are small, which significantly reduces the demand for automation systems.

There is an increased demand for automated distribution systems for energy resources (electricity and heat, gas distribution, water supply, transportation management systems, urban transportation, underground, airports, highways, etc.).

We may export industrial systems as finalized projects, or through Bulgarian companies, which have been chosen as subcontractors in the construction of projects abroad.

Companies on the Bulgarian market

Building of automation systems includes several main phases: technical design, software development, procurement of technical appliances and software, finalization, testing, assembly, release, servicing and personnel training. Each company may choose to complete all phases of this process, or only some of them.

The latest Catalogue on Bulgarian companies[*] consists of 35 Bulgarian companies in the field of automation and some of them are described in **Error! Reference source not found.**. Most of the companies (20) are located in Sofia and the rest are located in some industrial centres (Plovdiv - 3, Stara Zagora – 5, Haskovo – 2, Rousse – 2, Bourgas -, etc.).

The largest companies are:

- START ENGINEERING – works mainly in the field of heat energy. The company has established very good relationships with specialists from the Chemical and Technological University, and with the MIKONT Company as regards the implementation of MIK micro-processing systems. It also has business relations with leading foreign companies (e.g. SIEMENS).
- SIKONT - works mainly in the field of chemistry, black and ferrous metallurgy, energy, etc. and has effected more than 40 systems. It has a long-dated business relationship with SIEMENS.
- POINT-L – has a know-how for construction of automated distribution systems 4th generation, as well as a patent for remote reporting of the status of executive mechanisms.
- SAT – works mainly in the cement and the glass industries.
- TELECONTROL, DISI – works in the field of automated transportation systems (underground, electricity distribution, etc.).

Some of those companies are located in the CSRCA Technical Center, which is formed under the financing of the TRANSFORM Program of the German Economic Ministry.

Other companies produce individual or small series of specific technical means in order to satisfy the needs of the systems, implemented by them.

There are also foreign companies on the market and most of them are leaders in the field on the European and the world markets (SIEMENS, FESTO, FOXBOROUGH, HONEYWELL, SCHNEIDER, etc.). They have larger financial capabilities and better equipment than Bulgarian companies. Foreign companies often use own products (technical devices and finalized products) for the construction of systems in different industries. In some projects they subcontract Bulgarian companies as supplying agencies for different phases or supply the necessary equipment if the Bulgarian companies are the implementing agencies under the projects.

There are independent companies in the field of discreet processes, which manufacture automated machines and production lines for food and pharmaceutical industries (filling, dozing, and sealing equipment). In principle those companies do not integrate into the automation sector. Specialized firms supply most of the technical means needed for the finalization of their production.

Software for the CAD-CAM systems has been imported (mostly from abroad) to satisfy the needs of the machine building industry. This is done by specialized firms, which build-in and also adapt the products to the specific environment.

Innovation potential. Technological and market strategies.

- Human resources

All companies dispose of highly qualified specialists with a lot of practical experience. Experts from technical universities take part in the operational activity of some companies. The educational system for preparation of university and college specialists is good.

- Know-how

[*] Electronics, automation, electrical appliances – Bulgarian companies' catalogue, EL MEDIA EOOD, Sofia 2000

There have been no registered patents in this field. The know-how, itself, lies in the documentation on all designed systems and in the qualification of the individual specialists.

- Inventory

Companies are furnished with the insufficient technical equipment for design of automation systems.

- Financing

Companies do not have sufficient funds to finance research and development and to successfully participate in tenders for the automation of large industrial projects.

The main strategy of the companies is to closely co-operate with leading companies on the technology and the production side.

Overall assessment of the sector

Strengths

- The Bulgarian market is highly competitive due to the existing Bulgarian and foreign companies.
- Many Bulgarian companies have built up a good reputation and have established strong market positions thanks to their own system design and services.
- Many Bulgarian companies are certified under ISO 9000 and are co-operating with universities and foreign companies, which ensures the high quality of services.
- There are highly qualified specialists with sufficient experience and well-developed educational system.

Weaknesses

- The Bulgarian market is too compressed. There are also limited opportunities for playing on the foreign markets.
- The Bulgarian companies do not have the financial resources to participate in tenders for large public procurements.
- There is no research and development activity.

Opportunities

- The Bulgarian market should expand based on high and stable economic growth.
- Disclosure of new market segments related with competitive technologies and products (biotechnology, environmental protection, etc.).
- New necessities set by the development of modern infrastructure.
- General application of information technologies in research and design, servicing, contracting, etc.

Threats

- The liquidation of large enterprises and generation capacities – automation projects, may lead to the loss of markets.
- In most cases foreign investors choose to work with companies, they have long-dated relationships with.

Common issues of the Automation sector

Human Resources. Education potential for generation of new resources.

At the moment the Automation Sector (Automation means and devices and Systems for Industrial Automation) consists of about 2,000 employees. Most of them are specialists, having high technical or secondary school vocational degree in electronics, automation and computer engineering. Some of them used to work with former organizations for automation, such as CSRCD, IIMT, and the ITCR – BAC (Bulgarian Academy of Science), institutional organizations, etc. The good technical background and the affluent professional experience lead to the creation and the successful operation of private companies after 1990. Such examples are companies, such as SIKON, SAT, DESI, TELECOM, etc., established by former CSRCD research associates; DATEX, RISK-ELECTRONICS, MIKONT, ISOLAB, etc. – established by ITCR – BAS, etc.

Error! Reference source not found. shows that most research associates continue to work in the sector (research associates, PhDs, professors, associated professors, mostly in universities and the BAS).

Table 23 Scientists working within the Automation sector

Scientists	1994	1996	1997	1998
1. Automation, computer engineering and management systems				
Total Including:	**882**	**1,081**	**1,127**	**997**
- companies	154	122	191	168
- state sector	240	468	396	262
- universities	488	490	540	567
2. Electronics and electronic engineering				
Total Including:		572	592	495
- companies		154	106	60
- state sector		116	146	107
- universities		300	339	328

Source: National Institute of Statistics

Sector specialists are trained mainly in the Technical University of Sofia, which covers the largest variety of subjects, related with industrial automation in all industries and at all levels, as well as the CTU – Sofia, the technical universities in Varna, Rousse and Gabrovo, etc.

Each year there is around 250 graduates in automatics and automation, electronic and computer engineering, etc. and they satisfy the needs of the sector.

Specialists with secondary vocational education are prepared mainly in the colleges for electrical technology and electronics (26) and partly in some colleges for machine building and appliances.

Going forward the specialists with high and secondary degree will be enough to satisfy the needs of the sector.

Relations with Universities and the Bulgarian Academy of Sciences (BAS)

As seen from **Error! Reference source not found.** the universities have significant scientific potential, which will be enough to carry out scientific research and development in the fields of automatics, automation, electronics, appliances and other related fields. At the moment the relations between the faculties and departments of the universities, and companies are too limited. However, there are individual positive examples, such as the co-operation between one of the largest Bulgarian companies –

START ENGINEERING and the automation specialists from CTU – Sofia, when developing and installing automation systems in the energy and metallurgy sectors.

There is a forthcoming creation of a Scientific Centre for the FESTO Company, together with the Department for Automation of Discreet Production Processes with the Technical University – Sofia.

There is a significant scientific potential within the Bulgarian Academy of Science, where the former Institute for Technical Cybernetics and Robotics (ITCR) has been restructured into 4 separate scientific units with more than 250 employees, most of them with high degree.

According to some researches the main obstacle for the establishment of closer relations between the companies in the sector and the scientists in universities and BAS is the lack of financial resources. Surprisingly, around 50% of the questioned companies are of the opinion that such relations do not have a significant impact on the innovation processes.

Small- and medium-sized enterprises in the sector.

The sector is dominated by small and medium-scale enterprises. Their activities: development and outgrowth of new and existing generation technologies for market-oriented products and services make them innovative and technology driven companies. They have all positive and negative characteristics of the small and medium technological companies. The overcoming of their weaknesses is related with supporting them in the following directions: financing, qualification and information, production sales, gaining of new markets.

The Bulgarian experience in the operation of innovation technologies' centres (BIC-IZOT, IIMT, CRSCD) shows that most participating companies belong to this sector. The experience of Germany confirms this conclusion.

The "technological centres and parks" instrument may help the creation of new companies in the sector and their growth, the transfer of technologies and in advancing the regional development.

Recommendations

There are few recommendations that can be made based on the SWOT analysis of the sector, which will be subject to further discussions, details and evaluation within the overall project.

- The state strategy and policy in the sector should be carried out under the long-term National program for research and technological development, whereas in specific sectors it should incorporate tasks related with the construction of technical and software means and automation devices in order to achieve the synergy effect.
- To advance the technological development, incl. the sector under discussion:
    - The state budget should increase its financial allocations to the scientific and technological research and those funds should be disbursed mainly for financing the tasks of the National Program.
    - The research equipment and the equipment allowing for the participation of Bulgarian companies in international tenders for projects and programs should be exempt from import duties and taxes.
    - The depreciation timetable for computer equipment, software, scientific and research equipment, high technology equipment, incl. automation means, devices and systems, should be lowered.
- The financial inflows from the privatisation of the sector organisations, research centres and units should be used for supporting technological development.

- The building of a regional distribution network of technological centres and parks should be encourages, together with the establishment of an alliance between those technological centres and parks.
- With a view to develop applied research for the technology-oriented companies and production streams, a network should be built up based on the model and the experience of FRAUNHOFFER association in Germany.
- The planning and the management of the processes in the sector necessitates collection and processing of specialized information from the National Institute of Statistics and other organizations, which currently is not available.

Table 24 Producers and importers of technical automation means and devises

No	COMPANY	REGISTRATION	ACTIVITY
1	ALPHATECH	Stara Zagora	Import of technical devices: measuring devices for temperature, level, pressure, executive mechanisms.
2	DELTA INSTR.	Sofia	Production of measuring devices, transformers, regulators for temperature, pressure, level, concentration, etc.; import/export of technical devices.
3	KOMEKO	Plovdiv	Production and import of a wide range of measuring devices, transformers, controllers.
4	MICROSYST	Plovdiv	Production of sensors, transmitters, pH-meters, etc.
5	PRIBOR	Koprivshtitsa	Production of thermal sensors, regulators for temperature and level.
6	STS-HOLDING GROUP	Gabrovo	Production of inductive, capacity and optical measuring devices.
7	UNICOM MICROSYSTEMS	Sofia	Production and import of technical devices for distributed management systems.
8	UNISYST	Sofia	Production of technical devices for measuring of costs, thermal transformers, recording devices, regulators, etc.

Table 25 Bulgarian companies for automation systems

No	COMPANY	REGISTRATION	ACTIVITY
1	AQUASYST	Sofia	Refineries, energy consumption.
2	ACI – Engineering	Sofia	Water supply and distribution, food industry.
3	VEREYA Electronics	Stara Zagora	Food industry. Machine building industry.
4	VERCON	Stara Zagora	Textile industry, forage industry.
5	IZOMATIC KOMPLEX	Plovdiv	Energy.
6	MEGA Engineering	Haskovo	Food industry. Machine building industry.
7	MIKONT	Sofia	Energy, petro-chemistry.
8	CBM – 2	Haskovo	Food industry. Machine building industry.
9	SIKONT	Sofia	Chemical industry, metallurgy.
10	SAT	Sofia	Cement, ceramic, glass industries.
11	START Engineering	Sofia	Energy, district heating, metallurgy.
12	SIKA ‘99	Sofia	Dozing systems.
13	POINT – L	Sofia	Automated systems with distributed logic.

Table 26 Foreign companies – producers of technical automation means and systems

No	COMPANY	REGISTRATION	ACTIVITY
1	ABB – BULGARIA	Sofia	Continuos technological processes. Import of appliances and technical means from HARTMAN and BROWN.
2	GENERAL ELECTRIC	Sofia	Energy.
3	ROCKWELL AUTOMATION	Sofia	Regulated electricity activity, regulated controllers, measuring devices.
4	SIEMENS	Sofia	Continuos technological processes, measuring devices, transformers, regulated controllers, etc.
5	FESTO	Sofia	Energy, chemical industry, food industry, light industry.
6	FOXBOROUGH	Sofia	Continuos technological processes, measuring devices, regulators, executive mechanisms.
7	HONEYWELL	Sofia	Continuos technological processes, systems in public building.
8	SCHEIDER ELECTRIC	Sofia	Energy, chemical and extraction industry.
9	FANUK	Sofia	Black and ferrous metallurgy, energy, water.

Appendix 1 Competitiveness Ranking of Technology and Infrastructure - Tables

Ivaylo Gueorguiev, researcher, Center for Economic Development

Table 27 Technology - related competitiveness ranking

	Note	Bulgaria (WEF 1999)	Bulgaria (WEF 2000)	Czech Republic	Germany	Greece	Hungary	Poland	Russian Federation	Slovak Republic	Turkey	Ukraine
Tertiary education	rank	22	21	39	17	16	37	36	20	38	43	22
Tertiary education enrollment indicator.	1999 UNESCO Statistical Yearbook (1997)		41	22	47	47	24	25	***45***	22	21	***41***
Math and Science Education	rank	32	26	9	21	36	2	40	14	12	17	19
The school system in your country excels in math and basic science education.	1= strongly disagree 7 = strongly agree	4.73	4.9	5.5	***5***	4.4	5.9	4.4	***5.2***	***5.3***	***5.2***	***5.1***
Scientific research institutions	rank	35	34	35	7	42	26	33	18	30	38	28
Scientific research institutions are truly world class.	1= strongly disagree 7 = strongly agree	4.15	3.7	***3.7***	5.8	***3.4***	4.4	***3.8***	4.9	3.1	***3.6***	4.2
R&D spending	rank		39	24	7	41	36	32	30	27	42	25
R&D spending in GNP	% (UNESCO 1999 - last available year)		0.57	1.2	2.41	0.47	0.68	0.77	0.88	1.05	0.45	1.19
Research collaboration	rank	55	43	27	8	45	27	44	52	40	20	58
In its R&D activity company collaborate closely with local universities.	1= strongly disagree 7 = strongly agree	0	3.4	5	4.6	***3.4***	3.8	4.5	3.9	4.5	4.2	2.9
Private sector spending on R&D	rank	55	47	54	5	43	27	35	22	23	38	58
Companies in country spend heavily on R&D relative to international peers	1= strongly disagree 7 = strongly agree	2.38	2.5	***2.3***	5.3	***2.6***	3	2.8	3.4	3.4	2.8	2.1
Necessity of research by firms	rank	-	50	55	3	48	45	57	40	41	54	51
It is important for company to do its own R&D.	1= strongly disagree 7 = strongly agree	-	3.7	***4***	2.3	***3.7***	***3.6***	***4***	***3.5***	***3.5***	***3.9***	***3.7***
Licensing of technology	rank	56	54	27	22	36	25	44	52	40	3	58
Licensing of foreign technology is a common means to acquire new technology.	1= strongly disagree 7 = strongly agree	3.35	3.3	5	5.1	4.8	5	4.5	3.9	4.5	5.7	2.9
Intellectual property	rank	54	54	38	7	37	30	47	56	34	33	59
Intellectual property in country is well protected.	1= strongly disagree 7 = strongly agree	3.09	3.1	4	6.1	4.1	4.5	3.7	2.8	4.3	4.3	2.5
Technology sophistication	rank	57	55	35	6	46	33	45	37	32	30	51
Your country's position in technology ranks among the world leaders.	1= strongly disagree 7 = strongly agree	2.4	2.5	3.7	6.2	3.2	3.8	3.3	3.6	3.9	4.2	2.8
Brain drain	rank	-	59	22	4	39	37	28	44	46	32	51
Talented people remain in the country.	1= strongly disagree 7 = strongly agree	-	2.1	4.3	5.1	3.5	3.6	4.1	3.2	3.1	4	2.7

Table 28 Competitiveness indicators in telecommunications and Internet

	Note	Bulgaria (WEF 1999)	Bulgaria (WEF 2000)	Czech Republic	Germany	Greece	Hungary	Poland	Russian Federation	Slovak Republic	Turkey	Ukraine
Internet hosts	rank	38	39	25	18	29	23	33	38	30	42	45
Internet hosts number	number per m population (1998)	822	1152	8413	17686	4737	9500	3371	***1242***	4103	751	392
Internet access	rank	-	54	48	15	38	42	51	53	35	24	58
Internet access is fast and inexpensive.	1= strongly disagree 7 = strongly agree	-	3.7	4.2	5.9	4.6	4.2	***3.9***	***3.7***	4.8	5.4	3.2
E-mail	rank	54	55	16	21	51	40	54	56	53	22	59
Does your company use e-mail?	1= strongly disagree 7 = strongly agree	4.95	5.48	6.9	6.8	6.3	6.5	***5.5***	4.9	***5.8***	6.8	3.6
Internet for information	rank	55	56	9	16	32	42	29	57	54	20	58
Share of companies that use Internet for general information.	%	72.37	83.9	100	100	98.2	97	98.5	***83.9***	***87.1***	100	***83.9***
Internet for supplier relations	rank	58	56	29	12	50	54	30	44	13	40	58
Share of companies that use Internet for supplier relations.	%	33.33	47.1	68.4	75.9	54.9	***49.4***	67.3	59.6	75	61.8	***43.1***
Internet for customer service	rank	57	57	20	10	48	55	40	59	21	44	58
Share of companies that use Internet for customer service.	%	33.33	37.1	81	84.1	63	45.7	70.7	33.3	80	67.6	***35.7***
E-commerce	rank	57	58	31	5	54	53	15	55	9	42	48
Share of companies that use Internet for E-commerce.	%	14.5	12.8	45	67.5	24.4	24.7	55.3	22.5	62.3	39.4	31.5
Telephone density	rank	29	31	29	11	17	30	34	39	32	33	40
Number of main telephone lines.	per 100 persons (1998)		32.89	36.38	56.68	52.22	***33.58***	22.76	19.65	28.62	25.41	19.06
Satisfied demand by phone lines	rank	51	47	38	23	31	34	49	51	43	36	53
Satisfied demand for telephone lines.	waitlist (1998)		86.83	96.37	100	99.44	97.71	***83.03***	***80.3***	***89.81***	97.34	78.4
Cellular telephone density	rank	46	50	31	28	23	29	39	53	33	37	56
Cellular telephones number.	per 100 inhabitants(1998)	0.84	1.43	9.39	16.99	19.53	10.6	4.98	0.51	8.65	5.39	0.26
Cellular telephones	rank	59	57	43	31	38	33	48	56	51	25	59
Cellular telephones are widely used.	1= strongly disagree 7 = strongly agree	3.9	4.2	6	6.4	6.2	6.3	5.7	***4.3***	5.5	6.5	3.8
Telephone service	rank	55	58	44	8	35	34	51	54	40	30	57
Telephone lines have capacity and are highly reliable.	1= strongly disagree 7 = strongly agree	4.26	2.92	4.9	6.7	5.3	5.3	4.1	3.7	5	5.7	***3.1***
International telephone service	rank	58	57	44	17	28	46	49	47	35	24	54
Direct dial international phone service is among the worlds least expensive.	1= strongly disagree 7 = strongly agree	2.48	2.5	4	5.3	4.5	3.9	3.7	3.9	4.3	4.8	3.2

Table 29 Competitiveness indicators in transport infrastructure

		Bulgaria (WEF 1999)	**Bulgaria (WEF 2000)**	**Czech Republic**	**Germany**	**Greece**	**Hungary**	**Poland**	**Russian Federation**	**Slovak Republic**	**Turkey**	**Ukraine**
Railroad Indicator	rank	24	25	3	1	34	11	2	22	17	32	13
Railroad indicator.	positive number means a high value of railroad kilometers per land area		0.42	1.45	2.2	-0.21	1.11	1.47	0.56	0.82	-0.01	0.99
Cost of air travel	rank	23	30	43	41	28	31	46	13	34	42	n/a
Cost per kilometer of travel between two main domestic cities.	US$		0.376	0.647	0.588	***0.369***	***0.4***	0.843	0.242	***0.409***	0.625	n/a
Railroads	rank	33	34	26	4	45	38	35	18	27	43	29
Railroad is highly developed.	1= strongly disagree 7 = strongly agree	3.43	3.33	3.9	6.2	2.5	2.8	***3.4***	4.8	3.8	2.6	3.7
Road Indicator	rank	42	44	23	6	19	9	10	45	27	18	31
Road indicator.	positive number means a high value of road kilometers per land area		-0.49	0.16	1.64	0.57	1.26	1.17	***-0.53***	0.09	0.58	-0.03
Ports	rank	39	45	40	5	28	57	48	43	44	31	42
Port facilities and inland waterways are extensive and efficient.	1= strongly disagree 7 = strongly agree	3.66	3.6	***3.9***	6.3	4.6	2.7	***3.4***	***3.7***	***3.6***	4.3	***3.8***
Roads	rank	50	54	33	4	42	45	50	57	36	32	58
Roads are extensive and well maintenanced.	1= strongly disagree 7 = strongly agree	2.45	2.2	4.1	6.2	3.4	2.9	***2.3***	***2.1***	3.9	4.1	1.8
Air transport	rank	56	57	34	6	41	50	58	53	59	22	46
Air transport is extensive and efficient.	1= strongly disagree 7 = strongly agree	3.14	3.4	5	6.3	4.5	3.8	***3.4***	***3.7***	2.7	5.8	4

Legend:

	Cells shaded in gray color - the country has better rank than Bulgaria
000	Numbers in bold italic font - the indicator value for the country is around the value of Bulgaria (+/- 10%)
000	Numbers in bold gray font - the rank of Bulgaria is better than the previous year

Ranking is based on the competitiveness indicator and it is equal to the position of the country in a list of 59 countries sorted in descending order so that 1 = the best and 59 = the worst.

Source: World Economic Forum - The Global Competitiveness Report 2000, The Global Competitiveness Report 1999

Appendix 2 Aggregated Statistical for Bulgarian Economy and Technologies Development - Tables

Liliana Dudeva, senior researcher, Center for Economic Development

Table 30 Bulgaria: key macroeconomic and technology related indicators, 1991-1999

	1991	1992	1993	1994	1995	1996	1997	1998	1999*
Population, annual average, million	8,632	8,540	8,472	8,444	8,406	8,363	8,312	8,257	8,211
GDP, nominal, million $	8137	8605	10812	9688	13106	9946	10173	12257	12392
GDP /PPS/, million $	40391	39627	40447	42159	44712	41638	39466	40945	42451
GDP growth rate, 1989=100, %	-16.8	-22.8	-24.0	-22.6	-20.4	-28.5	-33.5	-31.1	-29.5
GDP annual growth rate, %	-8.4	-7.3	-1.5	1.8	2.9	-10.1	-7.0	3.5	2.4
GDP per capita, nominal, $	943	1008	1276	1147	1559	1189	1224	1484	1509
GDP /PPS/ per capita, $	4679	4640	4774	4993	5319	4979	4748	4959	5170
GDP per capita, annual growth rate, %	-6,0	-6,3	-0,7	2,2	3,3	-9,7	-6,5	4,2	3,0
Gross fixed capital formation, in % of GDP	18,2	16,2	13,0	13,8	15,3	13,6	10,8	11,6	15,9
Gross fixed capital formation, annual growth rate, %	.	-7.3	-17.5	1.1	16.1	-21.2	-23.9	16.4	25.3
Exports of goods and services, in % of GDP	43.5	47.1	38.2	45.1	44.7	62.9	61.9	48.0	44.1
Exports of goods and services, annual growth rate, %	.	.	.	.	.	.	3.1	-10.4	-5.2
Imports of goods and services, in % of GDP	39.2	52.9	45.8	45.7	46.3	59.8	56.4	50.9	51.9
Imports of goods and services, annual growth rate, %	.	.	.	.	.	.	-2.6	7.0	5.1
Net exports of goods and services, in % of GDP	4.3	-5.8	-7.6	-0.6	-1.6	3.1	5.5	-2.9	-7.7
Production of the industrial enterprises and establishments, annual growth rate, %	.	.	.	.	.	5,1	-10,0	-7,9	-12,5
Inflation, annual average, previous year =100, %	338,5	91,1	72,8	96	62,1	123	1082,3	22,3	1,79
Unemployment rate, registered end of period, %	11,09	15,27	16,38	12,78	11,08	12,52	13,69	12,17	15,97
General government expenditures (GFS definition), in % of GDP	49,4	48,8	51,5	49,5	45,4	52,4	34,8	36,9	40,3
General government deficit/surplus (GFS definition), in % of GDP	-4,4	-5,5	-11,7	-4,8	-5,2	-15,4	2,1	2,7	1,5
General government savings (GFS definition), in % of GDP	-0,7	-2,5	-9,0	-3,0	-3,0	-13,7	2,8	5,3	5,5
R&D expenditure, in % of GDP	1,53	1,64	1,18	0,88	0,62	0,52	0,52	0,59	.
Net coefficient of primary education enrollment (ISCED-1), %	.	.	.	.	92,8	94,9	95,5	96	96,8
Net coefficient of lower secondary education enrollment (ISCED-2A), %	.	.	.	.	79	78	78,4	79,1	80,2
Net coefficient of upper secondary education enrollment (ISCED-3A, 3C), %	.	.	.	.	61,4	61,5	61,5	61,3	62,1
Net coefficient of higher education enrollment (ISCED-5A, 5B), %	.	.	.	.	22.1	23.7	24.4	24.6	25.3

Sources: Bulgarian National Bank, IMF Staff country report No00/64 Bulgaria: Selected Issues and Statistical Appendix, National Employment Office, National Statistical Institute, www.nsi.bg , www.bcemag.com

Table 31 Gross domestic product, growth rates, 1999-2000 (corresponding period of the previous year = 100, %)

	I'Q1999	II'Q1999	III'Q1999	IV'Q1999	1999	I'Q 2000	II'Q2000	I'H2000
Bulgaria								
Production rates:								
Gross value added	-2,1	1,6	5,1	1,6	1,8	4,9	6.7	5.8
GVA by economic sector:								
Agricultural	5,2	1,0	6,2	-10,2	0,6	-10,1	-14.9	-12.9
Industrial	-9,2	-1,5	-1,0	-5,3	-4,4	6,2	8.8	7.5
Services	0,9	3,6	7,5	10,1	5,8	7,0	11.1	9.2
GVA by form of ownership:								
private	5,8	5,3	8,1	5,6	6,4	12,8	19.0	16.2
public	-12,0	-4,2	-2,5	-5,9	-6,3	-6,2	-13.5	-9.9
Adjustments	23,5	12,4	2,6	-3,7	7,4	4,3	-2.7	1.1
Final expenditure rates:								
Final consumption	11,3	6,4	-0,2	3,1	4,7	5,9	1.5	3.6
individual	12,7	8,1	-0,6	3,1	5,2	3,7	0.6	2.1
collective	-1,6	-8,6	4,3	3,7	-0,4	28,8	10.2	19.2
Gross fixed capital formation	6,5	23,1	35,0	27,1	25,3	18,0	12.1	14.2
Exports of goods and services	-18,9	-12,1	2,5	7,6	-5,2	27,2	25.9	26.5
Imports of goods and services	-2,0	5,2	8,1	8,5	5,1	20,4	11.9	15.8
GDP of Bulgaria	**0,8**	**2,7**	**4,8**	**1,0**	**2,4**	**4,8**	**5.5**	**5.2**
GDP of 13 candidate countries	.	.	.	.	-0,2	.	.	.
GDP of EU15	1,8	2,0	2,5	3,2	2,3	3,3	3,7	.
GDP of USA	3,9	3,8	4,3	5,0	4,2	5,3	6,0	.
GDP of Japan	-0,4	0,7	1,0	-0,2	0,2	0,7	0,8	.

Sources: Eurostat, News release № 104, 85, 80, 78, 46/ 2000

National Statistical Institute, http://www.nsi.bg

Table 32 Key macroeconomic and technology related indicators on 13 candidate countries, 1998

	Bulgaria	Cyprus	Czech Rep	Estonia	Hungary	Latvia	Lithuania	Malta	Poland	Romania	Slovakia	Slovenia	Turkey	EU15
Population, in 1000s	8230	663	10290	1446	10092	2439	3701	378	38667	22489	5393	1978	63451	374888
GDP at current prices, in 1000 Mio ECU	11.0	8.1	50.1	4.6	41.9	5.7	9.6	3.1	140.2	36.9	18.1	17.4	175.8	7585.6
GDP annual growth at constant prices, %	3.4	5.0	-2.3	4.0	5.1	3.6	5.1	4.1	5.0	-7.3	4.4	3.9	2.8	2.7
GDP index at constant prices, 1995=100, %	86.5	109.8	101.7	119.5	111.4	116.2	118.1	113.6	118.9	89.7	118.5	112.5	118.3	106.8
Gross value added by sector, % :														
- Agriculture	21.1	4.6	4.5	6.2	5.9[1]	4.7	10.1	2.8	4.8	17.6	4.6	3.9	16.1	2.3[2]
- Industry	28.7	21.9	41.8	26.3	32.7[1]	29.5	31.5	27.5	36.5	40.7	33.3	37.7	27.4	30.7[2]
- Services	50.2	73.5	53.7	67.5	61.4[1]	65.8	58.4	69.7	58.7	41.7	62.1	58.4	56.5	67.0[2]
GDP per capita in PPS[3], EU15=100	23	78[1]	60	36	49	27	31		39	27	46	68	37	100
Industrial production index, 1995=100, %	82.6	99.4	108.3	120.0	129.4	123.8	116.1	103.7	127.0	85.8	109.1	105.8	86.8	107.2
Annual growth rate of industrial production in 1998, %	-12.7	2.8	1.6	1.8	12.6	3.1	7.0	0.7[1]	4.8	-17.0	3.6	3.7	1.3	3.3
Monthly gross nominal wage, ECU	106	1306	322	262	282	201	222	.	335	136	253	850	565[1]	
Economic activity rate, %	50.4	61.5	61.0	61.2[1]	51.7	58.8	61.4	.	57.3	63.6	59.9	59.4	51.3	67.5[1]
Unemployment rate, %	16.0	3.3	6.5	9.9	7.8	13.8	13.3	5.1	10.6	6.3	12.5	7.9	6.4	10.0
Employment in agriculture, % of total employment	25.7	9.6	5.5	9.4[1]	7.5	18.8	21.0	1.8	19.1	40.0	8.2	11.5	42.3	5.2[1]
Retired persons' share of total population,%	29.0	.	24.5	25.7	31.3	26.9	25.1	15.4	24.4	18.1	21.9	23.7	.	.
Annual average inflation rate, %	22.3	2.2	10.7	10.5	14.3	4.7	5.1	2.4	11.8	59.1	6.7	7.9	84.6	1.3
CPI, 1995=100, %	3224.4	109.0	130.7	151.3	167.0	133.4	142.7	108.2	154.0	578.4	119.8	128.6	618.4	105.4
Appreciation/depreciation of national currency against ECU, 1995=100, %	4.5	102.5	95.5	95.2	68.4	104.4	116.7	106.1	80.9	26.7	98.3	83.3	0.2	
General government deficit/surplus in % to GDP	-0.3[1]	-0.9[4]	-2.2[1]	2.6[1]	-5.4[1]	1.8[1]	-0.7[1]	-7.7[2]	-2.6[1]	-3.5[2]	-4.4[1]	-1.5[1]	-7.2	-1.5
Trade balance, Mio ECU	-607	-2354	-2198	-1376	-2409	-1232	-1858	-742	-16792	-3154	-2045	-936	-16359	+19200
EU share of total imports, %	45.0	61.9	63.3	60.1	64.1	55.3	50.2	45.0	61.9	63.3	60.1	64.1	55.3	50.2
EU share of total exports, %	49.7	50.4	64.2	55.1	72.9	56.6	38.0	69.3	65.9	57.7	50.4	69.4	52.4	
Country share of total extra-EU trade, %	0.3	0.2	2.2	0.3	2.2	0.2	0.3	0.2	3.1	0.8	0.8	0.8	2.5	
EU FDI stocks held in the economy, at end of 1997, Mio ECU	347	269	7669	399	8120	177	390	.	7165	748	1290	809	3489	658570
Number of cars per 1000 inhabitants	219	375	358	312	220	198	265	634	230	110[1]	222	402	61	447[2]
Length of motorways, km	319	204	498	74	448		417	157	268	113	288	249	1726	46845[2]
Railway network in km per 1000 km2	38.7	.	120.0	22.5	83.0	37.0	40.0	.	74.0	46.2	75.0	59.0	11.1	48.4[2]
Emissions of carbon dioxide in tons per head	7.5[4]	.	12.9[2]	14.6[2]	6.3[2]	4.4[2]	5.1[1]	.	9.7[2]	4.7[1]	8.4[1]	7.8[1]	.	8.2[4]
R&D expenditure, Mio ECU	65	19	630	29	285	24	55	.	1022	184	156	228[1]	.	141200
R&D expenditure, as % of GDP	0.59	0.23	1.27	0.62	0.68	0.45	0.57	.	0.73	0.50	0.86	1.42[1]	.	1.86
Share of R&D expenditure by business sector, %	18.7	13.9	64.6	19.6	38.4	21.0	1.8	.	41.5	76.7	65.8	53.0[1]	.	63.7
R&D personnel, growth rate 1994-1998, %	-31.8	.	21.2	.	3.8	-11.8	-3.1[5]	.	8.8	-12.3	-0.7	-4.2[1]	.	3.7
R&D personnel[1], FTE per 1000 labour force	7.3[2]	1.3	4.5	.	5.2	3.7	6.7	.	4.9	4.6	6.5[4]	8.3	1.0	9.5
R&D personnel[1], FTE	11980	.	12580	4529	11154	2610	7800	.	55602	28431	9993	4022	23432	1601900
Researchers[1], % share by sector:														
- Government sector	62.7	.	36.6	24.2	35.1	39.5	38.6	.	21.1	22.4	24.7	35.8	11.9	14.6
- Business sector	14.9	.	40.7	-	27.3	9.0	1.6	.	19.9	68.0	33.9	35.0	17.1	48.6
- Higher education	22.4	.	22.7	75.8	37.6	51.5	59.7	.	59.1	9.6	41.4	29.2	71.0	35.6
Internet hosts number, per 1000 inhabitants	1152	.	8413	.	9500	.	.	.	3371	.	4103	.	751	.
PCs per 1000 inhabitants	30.1[1]	.	97.28	.	59.42	.	.	.	43.90	.	65.08	.	23.83	.
Number of main telephone lines per 100 persons	32.89	.	36.38	.	33.58	.	.	.	22.76	.	28.62	.	25.41	.
Cellular telephone numbers per 100 inhabitants	0.84	.	9.39	.	10.6	.	.	.	4.98	.	8.65	.	5.39	.

[1] 1997; [2] 1996; [3] GDP expressed in purchasing power standards. [4] 1995 [5] 1996-1997

Sources: Eurostat, Memo10/99, 7 December 1999, EU Enlargement, Key Data on Candidate Countries;Eurostat, News release № 69/2000,16 June; N 130/2000, 20 November. The Global Competitiveness Report 2000, The Global Competitiveness Report 2000 (Barro and Lee 2000, 1999 UNESKO Statistical Yearbook, World Telecommunications Indicators database, International Telecommunications Union)

Table 33 High-tech sector value added in Bulgaria, 1996-1998

Indicators	Total economy	High-tech sector Total	Higher hi-tech manufacturing sector (NCEA - 35, 37)	35	37	Medium hi-tech manufacturing sector (NCEA - 27, 34, 36, 38, 39, 40)	27	34	36	38	39	40	High tech services (NCEA – 68, 76, 77)	68	76	77
Total																
Share to total economy GVA, %																
1996	100	9.9	0.2	0.1	0.1	7.9	3.8	2.2	0.7	0.2	0.2	0.7	1.8	1.7	0.1	0.1
1997	100	9.6	0.7	0.1	0.6	6.6	2.9	2.3	0.6	0.1	0.2	0.6	2.2	2.0	0.1	0.1
1998	100	7.7	0.2	0.1	0.1	4.9	1.5	2.2	0.5	0.1	0.1	0.5	2.6	2.4	0.1	0.1
Structure of high-tech sector value added, %																
1996	x	100	2.2	1.1	1.1	79.4	37.7	22.4	7.5	1.9	2.5	7.2	18.5	16.7	1.0	0.8
1997	x	100	7.4	1.1	6.3	69.5	30.7	23.6	6.3	1.3	1.8	5.8	23.1	21.1	1.2	0.8
1998	x	100	2.5	1.0	1.5	64.0	19.2	28.4	6.5	1.9	1.6	6.4	33.6	31.1	1.6	0.8
Value added/output ratio, %																
1996	41.5	38.6	31.0	26.3	37.5	36.9	33.8	41.4	31.7	49.2	46.1	45.4	50.1	53.3	31.5	32.9
1997	40.6	36.5	28.5	20.8	30.5	33.6	27.6	43.8	30.5	38.2	47.8	40.9	56.4	58.8	39.9	38.5
1998	45.0	35.1	26.6	18.3	37.5	30.0	20.4	40.2	31.4	41.0	38.3	33.3	54.0	56.2	33.9	40.1
Value added per employee, at current prices, denominated leva																
1996	736	532	217	282	178	600	1365	337	447	338	589	648	403	600	324	52
1997	7097	4707	2154	2992	1609	4900	9662	3343	3600	2316	4078	4893	4640	6827	3815	530
1998	9252	5419	3090	3167	3040	4989	6519	4505	4033	3511	4041	6090	6999	10361	5048	539
Value added per employee, at current prices and annual average exchange rate, $																
1996	4186	3026	1237	1603	1012	3414	7762	1914	2545	1925	3351	3686	2291	3415	1845	297
1997	4233	2808	1285	1785	960	2923	5763	1994	2148	1381	2432	2919	2768	4072	2276	316
1998	5256	3078	1755	1799	1727	2834	3703	2559	2291	1994	2295	3460	3976	5886	2868	306
Private sector																
Private sector share in value added, %																
1996	55,4	7,8	16,8	3,9	29,2	7,6	4,6	10,4	7,1	8,5	42,7	3,4	7,5	3,9	67,6	7,5
1997	63,0	27,6	53,8	62,8	42,9	32,5	29,1	32,2	51,9	25,9	43,2	28,4	10,5	6,1	85,8	12,2
1998	63,4	36,0	62,8	75,2	54,5	46,9	44,1	44,5	79,8	42,2	64,4	29,9	12,6	9,3	73,6	14,5
Structure of private high-tech sector value added, %																
1996	x	100	4.6	0.5	4.1	77.7	22.4	29.8	6.8	2.1	13.4	3.2	17.7	8.2	8.7	0.8
1997	x	100	13.7	2.4	11.3	78.0	30.9	26.3	11.3	1.2	2.6	5.7	8.3	4.5	3.5	0.4
1998	x	100	4.4	2.1	2.3	83.8	23.5	35.3	14.4	2.3	2.9	5.4	11.8	8.1	3.4	0.3
Value added/output ratio in the private sector, %																
1996	51.7	27.3	15.3	3.3	29.2	29.0	26.1	31.7	22.2	24.4	43.6	17.5	26.2	25.3	26.7	31.9
1997	47.1	29.9	24.6	15.7	28.0	30.7	28.1	33.2	28.0	30.5	36.4	41.8	33.7	31.2	37.9	31.4
1998	48.5	29.0	22.4	16.3	33.9	29.2	22.3	33.8	30.0	34.3	35.3	38.6	30.9	31.6	29.5	31.7

Source: National Statistical Institute and own calculations on National Statistical Institute primary data based on the annual reports of the revenues and expenditures of the industrial enterprises and establishments.

Table 34 Production of the industrial enterprises and establishments, growth rates 1996-2000

(since the beginning of the year over the corresponding period of the previous year, %)

NACE Rev.1	NCEA	Activity groupings	1996	1997	1998	1999	1'00	2'00	3'00	4'00	5'00	6'00	7'00	8'00	9'00
		Industry, total	5,1	-10,0	-7,9	-12,5	5,2	1,2	5,2	4,1	3,9	3,2	1,7	2,0	3,3
		Manufacturing	4,8	-12,0	-11,0	-13,2	3,0	0,0	4,3	2,7	3,5	3,8	2,7	3,0	3,6
		Higher tech manufacturing sector:													
30	35	Office machinery and computers	40,9	-6,7	-22,1	-24,5	29,7	55,1	66,2	37,6	42,3	45,6	47,9	47,3	42,2
32	37	Radio, television and communication equipment and apparatus	-35,9	-21,2	20,9	8,2	65,7	40,9	47,6	53,7	59,8	62,3	53,4	54,1	45,3
		Medium high tech manufacturing sector:													
24	27	Chemicals and chemical products	19,5	-9,0	-24,8	-18,4	22,8	9,1	6,1	5,2	5,8	7,5	6,5	8,6	11,0
29	34	Machinery and equipment	-0,8	0,9	-2,0	-11,9	-18,6	-32,4	-32,9	-22,6	-19,6	-12,5	-11,1	-14,9	-13,8
31	36	Electrical machinery and apparatus	9,5	-14,4	-13,4	-11,3	2,3	2,9	12,7	11,7	12,5	6,7	2,9	3,9	3,6
33	38	Medical, precision and optical instruments	-10,0	-19,7	11,0	-6,8	-25,6	-18,3	-7,7	-18,6	-9,0	-14,4	-15,7	-11,5	-11,5
34	39	Motor vehicles, trailers and semi-trailers	-14,7	-16,9	-31,6	-3,5	21,3	-3,7	-4,3	-3,5	-1,2	-11,8	-11,0	-5,9	-5,8
35	40	Other transport equipment	-2,5	-15,6	17,9	-53,6	121,8	10,8	-18,0	-27,9	-19,1	-13,4	-0,9	-3,8	5,2
		Private sector													
		Higher tech manufacturing sector:													
30	35	Office machinery and computers	51,4	92,8	-19,2										
32	37	Radio, television and communication equipment and apparatus	-6,6	9,4	32,5										
		Medium high tech manufacturing sector:													
24	27	Chemicals and chemical products	130,2	327,2	3,8										
29	34	Machinery and equipment	-7,8	208,6	27,0										
31	36	Electrical machinery and apparatus	50,7	256,7	16,7										
33	38	Medical, precision and optical instruments	18,0	31,9	59,2										
34	39	Motor vehicles, trailers and semi-trailers	40,2	1,9	-16,7										
35	40	Other transport equipment	34,7	113,2	9,1										
		Public sector													
		Higher tech manufacturing sector:													
30	35	Office machinery and computers	34,5	-74,4	-37,0										
32	37	Radio, television and communication equipment and apparatus	-46,3	-40,6	7,3										
		Medium high tech manufacturing sector:													
24	27	Chemicals and chemical products	15,7	-31,1	-36,4										
29	34	Machinery and equipment	0,4	-30,0	-20,8										
31	36	Electrical machinery and apparatus	5,3	-55,1	-48,7										
33	38	Medical, precision and optical instruments	-16,8	-33,6	-14,3										
34	39	Motor vehicles, trailers and semi-trailers	-36,7	-33,4	-50,8										
35	40	Other transport equipment	-5,5	-30,4	20,9										

Source: National Statistical Institute

Table 35 Production of the industrial enterprises and establishments by selected activity groupings, 1996-1998 (annual growth rates, %)

NACE Rev.1	NCE A	Activity groupings	1996	1997	1998
24	27	Chemicals and chemical products (NCEA 27)	19,5	-9,0	-24,7
	271	Basic chemicals	21,4	-14,4	-38,4
	272	Pesticides and other agro-chemical products	-39,5	-17,9	2,0
	273	Paints, varnishes and similar coatings, printing ink and mastics	8,2	-9,5	-8,6
	274	Pharmaceuticals, medicinal chemicals and botanical products	40,8	-3,3	-16,7
	275	Soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	31,5	2,4	-15,3
	276	Other chemical products	-34,8	-11,2	133,9
	277	Man-made fibres	-12,5	8,6	-14,6
31	36	Electrical machinery and apparatus (NCEA 36)	9,5	-14,4	-13,3
	361	Electric motors, generators and transformers	-2,4	-9,5	-16,8
	362	Electricity distributions and control apparatus	-21,5	-11,5	23,5
	363	Insulated wire and cable	17,6	-29,1	-16,7
	364	Accumulators, primary cells and primary batteries	14,2	-4,4	-24,1
	365	Electric lamps and lighting equipment	19,7	-2,4	-3,9
	366	Other electrical equipment	44,5	-13,6	-19,4

Source: National Statistical Institute

Appendix 3 Detailed Analysis of Technology and R&D Related Statistical Data Compared to Selected European Countries

Reni Petkova, chief of department, National Statistical Institute

The state and development of the high technology sectors in Industry and Services in Bulgaria can be analysed by a number of statistical indicators classified into several groups corresponding to major economic areas influenced by industrial and technology policy in the country: R&D; Employment and unemployment; Investment; Output; Foreign trade.

RESEARCH AND DEVELOPMENT

R&D expenditure

Expenditure on R&D is a common indicator of science and technology activity in the national economy. In 1998 R&D expenditure amounted to 127598 million Lv at current prices, which reversed the previous five-year sustained tendency of decrease in real terms. It is difficult to make a precise estimate of the real reduction of R&D expenditure not only because of the effects of inflation but also of the drastic changes in budgetary funding of science. Comparison of the volume indices at 1995 constant prices (the implicit deflator of GDP is used as a deflator) shows that between 1993 and 1996 R&D expenditure decreased annually from 29% to 24%. In 1997 the negative trend had dropped to 7.7% compared with the previous year while in 1998 a growth of 17.9% was realized.

Table 36 R&D expenditure in the period 1993 – 1998 / million Lv/

	1993	1994	1995	1996	1997	1998
R&D expenditure at current prices	3539	4601	5447	9148	88591	127598
R&D expenditure at constant prices	9941	7493	5447	4139	3820	4503
Volume indices, preceding year=100	70.7	75.4	72.7	76.0	92.3	117.9

Source: National Statistical Institute.

The downward trend of R&D expenditure is typical for all candidate countries for EU membership during transition period to a market economy, though being different in its intensity and duration. Total R&D expenditure for the European Union has steadily increased over the past ten years.

Table 37 R&D expenditure in candidate countries for EU membership and in EU, 1990 – 1998 / million ECU/

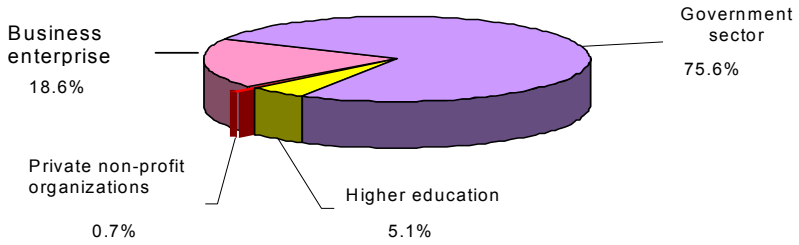
	1990	1991	1992	1993	1994	1995	1996	1997	1998
Bulgaria	387.8	93.9	109.1	109.4	71.5	62.0	40.6	46.4	65
Cyprus	:	8.4	9.6	:	:	:	:	:	19
Czech Republic	543.0	416.5	395.2	360.9	379.2	402.8	:	541.7	630
Estonia	:	:	:	:	:	:	:	:	29
Hungary	414.4	288.5	302.2	322.3	310.7	250.5	231.7	291.8	285
Latvia	:	:	6.2	9.0	13.0	17.8	18.7	21.1	24
Lithuania	:	:	:	:	18.4	22.2	32.9	48.0	55
Poland	445.8	499.1	540.4	609.8	636.6	672.4	806.8	904.4	1022
Romania	:	182.8	128.1	206.7	195.5	195.8	195.9	180.6	184
Russia	17673.0	9657.5	562.6	1206.2	1967.2	2025.9	2984.1	3727.0	2303.0
Slovakia	:	:	:	:	117.3	138.3	149.9	203.2	156
Slovenia	255.1	235.8	184.6	173.5	210.1	243.1	214.3	228.3	228*
European Union	105500	112200	115600	117000	120300	124200	129400	135300	141200

Source: Eurostat.

R&D expenditure by sector of performance

The distribution of R&D expenditure by sector of performance shows that the largest part of research and technology activity in Bulgaria: 74.6% is carried out in scientific organizations and research institutes (predominantly budgetary-funded) within the government sector. In 1998 just about one-fifth (18.6%) of total R&D expenditure, amounted to 23781 million Lv, was spent in the business sector by enterprises producing market goods and services, among which are those manufacturing technological products. This share was 4.3 percentage points below the previous 1997 level and three-fold less compared with 1996 level. Higher education sector comprised 5.1% in total R&D expenditure and Private non-profit organizations was 0.7%.

Figure 16 R&D expenditure by sector of performance in 1998

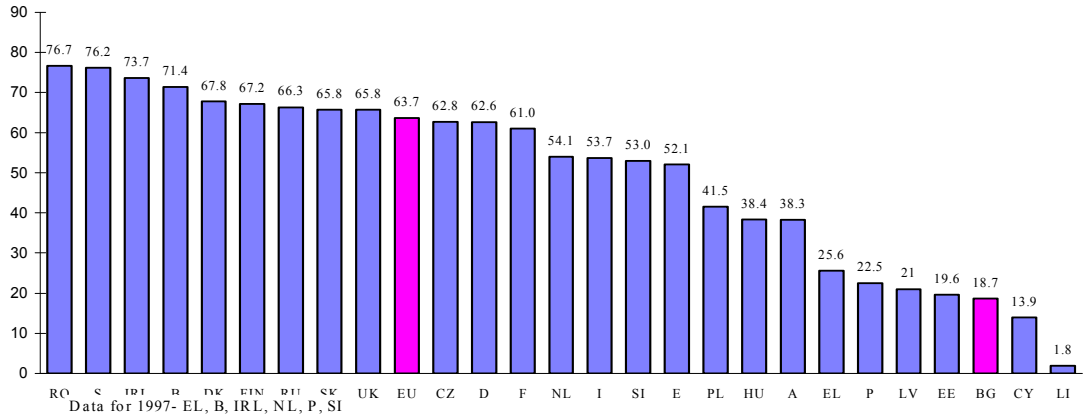


Source: National Statistical Institute

The dominant position of the government sector, which continues to hold the initiative in scientific and technology development in Bulgaria, is not typical for EU member states. In most of these countries the business enterprise sector plays a key role in R&D performance. In 1998 it comprised between 76.2% in Sweden and 52.1% in Spain and the average EU level accounted to 63.7% of total R&D expenditure.

According to the share of R&D expenditure carried out by business enterprise sector Bulgaria is ranking ninth among candidate countries for EU membership, leaving behind only Cyprus (13.9%) and Lithuania (1.8%).

Figure 17 R&D expenditure in business enterprise sector in 1998, %



Source: Eurostat

The low share of business enterprise sector in R&D expenditure in Bulgaria, as compared with European countries, is partly due to the weak innovative activity of the enterprises as well as to differences in the institutional structure of R&D activity, the role and position of academies in which the major part of basic research is carried out, in contrast to EU member states where it is concentrated in the Higher education sector.

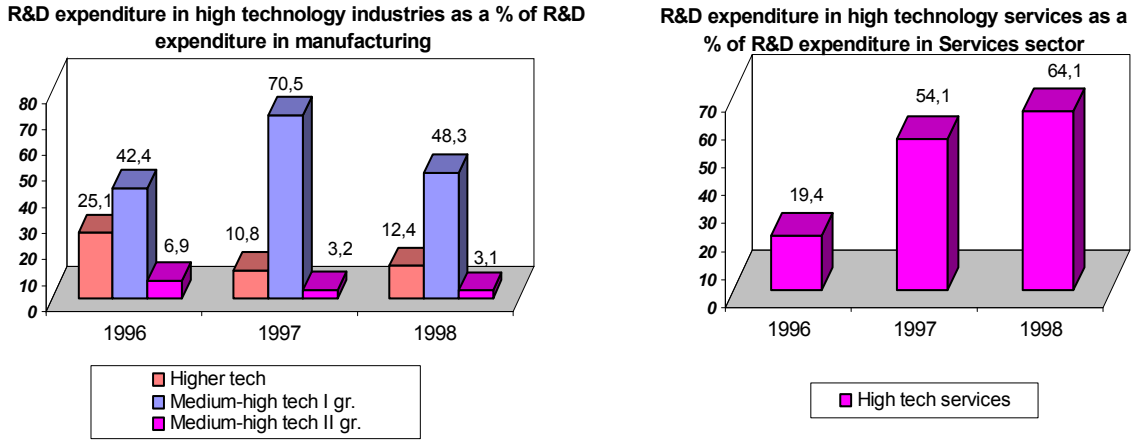
R&D expenditure in the high technology sectors of manufacturing and services

In 1998 R&D expenditure spent for development of the high technology industries within the business enterprises sector amounted to 9222 million Lv and comprised 63.8% of R&D expenditure in manufacturing, which is below the previous two years' levels: 84.5% in 1997 and 74.3% in 1996. This trend reflects mainly development of medium-high tech I group industries, which accounted for the bulk of R&D expenditure: 42.4% in 1996, 70.5% in 1997, and 48.3% in 1998. Most significantly to this contributed the branch "manufacturing of chemicals and chemical products", concentrating 35.9% of all R&D expenditure in manufacturing.

R&D expenditure in the higher tech industries in 1998 was closely four times less than that in the medium-high tech I group industries and comprised 12.4% of R&D expenditure in manufacturing in contrast to most European countries where this share accounted for over 50%. Medium-high tech II group industries amounted for the smallest share in manufacturing R&D expenditure: 3.1%.

The share of R&D expenditure spent for high technology services increased in the period under review, reaching in 1998 64.1% of R&D expenditure in the Services sector. The major part of this expenditure was carried out for development of telecommunications.

Figure 18 R&D Intensity in high tech sectors



Source: National Statistical Institute.

R&D intensity

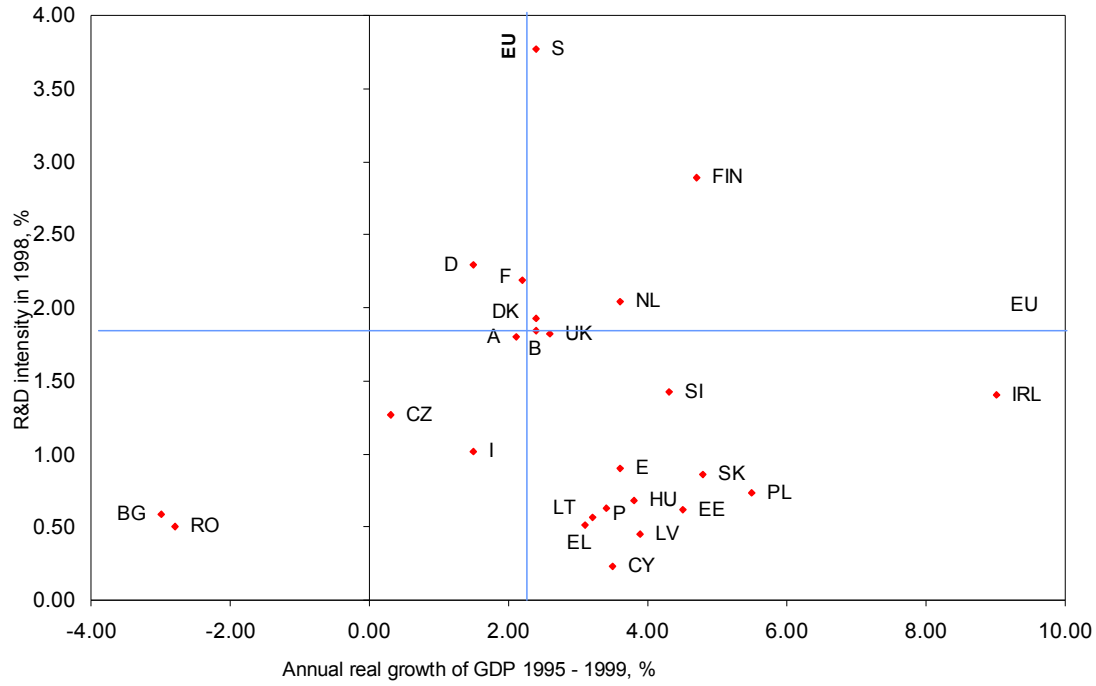
R&D intensity measured as a percentage of R&D expenditure in the gross domestic product is a key factor for economic growth as it enhances the capacity of the national economy to develop, implement and diffuse new technologies.

The real growth of 17.9% of R&D expenditure realized in 1998 as compared with the preceding year contributed to a 0.07 percentage point increase in its share in the gross domestic product, reaching 0.59%, still below the average EU level: 1.86%.

The low level of this indicator is a result of a drastic decline in R&D intensity in the period 1990 – 1997: from 2.38% to 0.52%, which could not be rapidly compensated by emerging signs of recovery in technology activity started in 1998.

Comparison of economic growth rates and R&D intensities of the candidate countries for EU membership shows that over the past five years most of these countries have realized relatively high GDP growth rates in spite of their relatively low R&D intensities. This trend is typical for the catching-up phase of the economy and reflects assimilation and accumulation of technological information and external knowledge. The only exceptions are Bulgaria, Romania and the Czech Republic where economic restructuring is still underway.

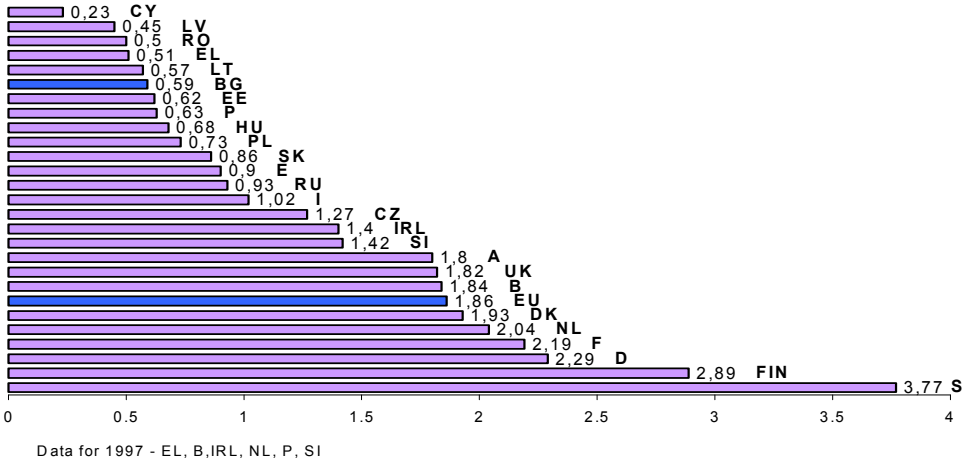
Figure 19 R&D intensity in 1998 and annual real growth of GDP, 1995 - 1999



Source: Eurostat

In all candidate countries for EU membership R&D intensity is lower than the average European level and only in Slovenia and the Czech Republic it accounts for over 1%. By this indicator Bulgaria is ranking seventh among candidate countries, leaving behind Lithuania (0.57%), Romania (0.50%), Latvia (0.45%), and Cyprus (0.23%). Compared with EU member states Bulgaria is in a better position than Greece (0.51%) alone.

Figure 20 R&D expenditure as a percentage of GDP in 1998



Source: Eurostat

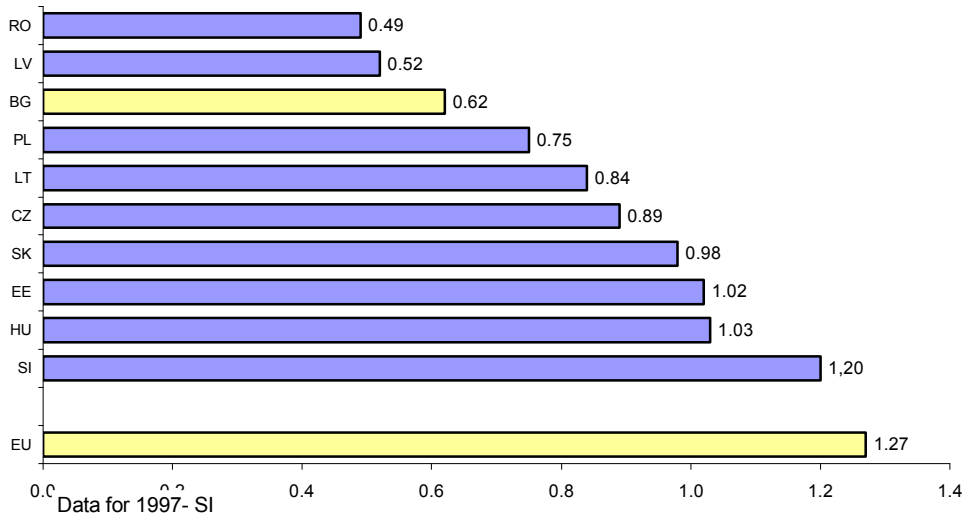
R&D personnel

Successful development of R&D activity depends both on adequate funding and availability of highly qualified specialists with the required knowledge and skills for developing and implementing new technological products and processes.

The downward trend in the number of R&D personnel has sustained in recent 3-4 years. In 1998 research activity has been carried out by 21766 persons, from which 14045 researchers, 5439 technicians and 2282 other personnel. The number of R&D personnel declined by 31.9% compared with 1996, or by 10176 persons. Their overall number recalculated in full-time equivalents in terms of working hours spent on R&D in 1998 totaled 19116 persons, or 26.9% less than in 1996.

As a result of this decline the share of R&D personnel in head count as a percentage of the labour force dropped from 0.89% in 1996 to 0.62% in 1998. According to the level of this internationally comparable indicator characterizing personnel engaged in scientific and technology activity, Bulgaria leaves behind only Romania (0.49%) and Latvia (0.52%) from among candidate countries and is well below the average level of EU member states: 1.27%.

Figure 21 R&D personnel as a percentage of labour force in 1998

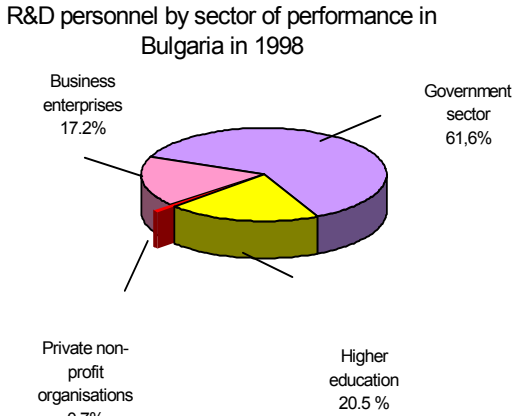


Source: Eurostat

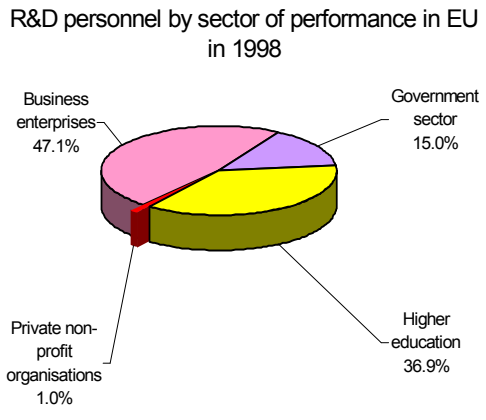
R&D personnel by sector of performance

The distribution of R&D personnel by sector of performance reflects the structure of R&D expenditure. The largest employer in 1998 is government sector with 13409 employed, or 61.6% of all persons engaged in R&D. The number of R&D personnel in the business enterprise sector is considerably smaller: 3751 or 17.2% against 47.1% on average for the European Union. The share of R&D personnel in the Higher education sector is 20.5% against 36.9% on average for the EU.

Figure 22 R&D personnel by sector of performance in Bulgaria



Source: NSI.



Source: Eurostat.

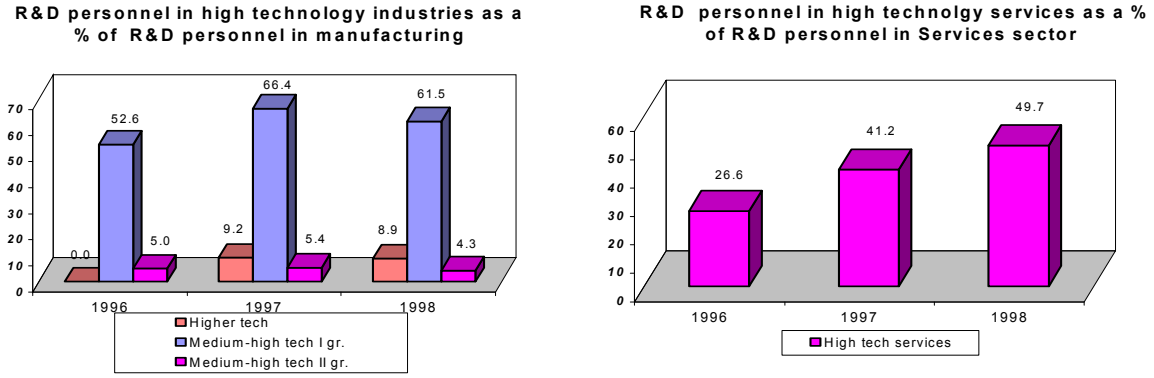
R&D personnel in the high technology sectors of manufacturing and services

In contrast to the downward trend in the number of R&D personnel in the national economy and in the manufacturing, research personnel engaged in high technology industries increased by 13.4% in 1998 compared with 1996. The number of R&D personnel in the medium-high tech I group industries rose most significantly. As a result in 1998 it accounted for 61.5% of R&D employed persons in

manufacturing against 52.6% in 1996. A decrease occurred only in the medium-high tech II group industries, by 0.7 percentage points, from 5.0% in 1996 to 4.3% in 1998, a result of the reduced number of research personnel in the branch "manufacturing of other transport equipment".

In the period 1996 - 1998 the number of R&D personnel employed in the high technology services increased faster than the number of R&D personnel in the Services sector. As a result in 1998 research personnel engaged in high technology services accounted for half of R&D personnel in the Service sector. The majority of it is engaged in the telecommunications.

Figure 23 R&D personnel in high tech sectors



Source: National Statistical Institute.

EMPLOYMENT AND UNEMPLOYMENT

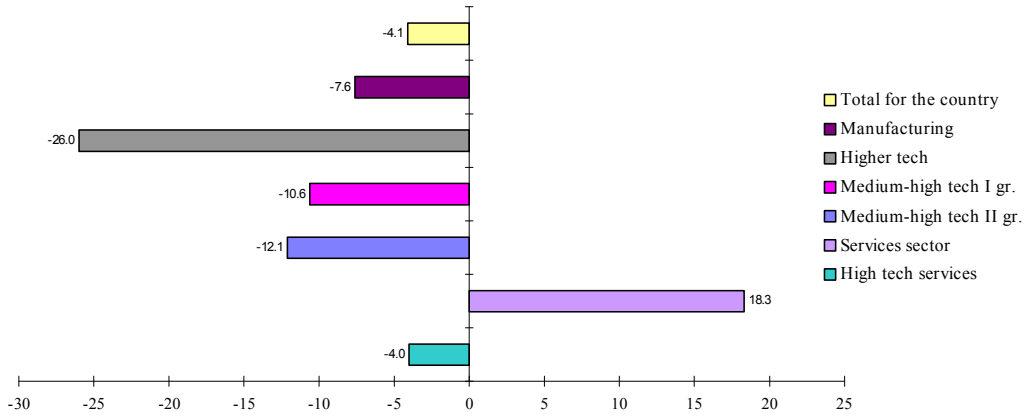
Employment in the high technology sectors of manufacturing and services

In the period 1996 – 1998 a downward trend in the number of employed persons in all eight high technology industries is observed. This negative tendency is in line with the overall decline of employment in the national economy by 4.1%, but yet stronger. In 1998 the employed persons in the high technology industries was 213127, which is a 12% decline, or 8968 job losses compared with 1996.

The most significant decline occurred in the higher-tech industries, by 26%, mainly due to a reduction of employed persons in "manufacturing of radio, television and telecommunication equipment and apparatus". The decrease in the number of employed in the medium-high tech I and II groups industries, 10.6% and 12.1% respectively, is close to the average level for the high technology industries as a whole, and is larger than the employment decline in the manufacturing as a whole: 7.6%. The largest job losses - 20072 occurred in medium-high tech I group industries where are engaged about 80% of all employed persons in the high technology industries.

In contrast to the positive trend in the number of employed in the Services sector as a whole, an increase of 18.3% in 1998 from 1996, the number of persons employed in the high technology services dropped by 4.0%. This fall is entirely due to the 10.7% employment decline in research services, which could not be compensate by higher employment in telecommunications and information services.

Figure 24 Employment growth rate in high technology industries and services, 1996 - 1998



Source: National Statistical Institute

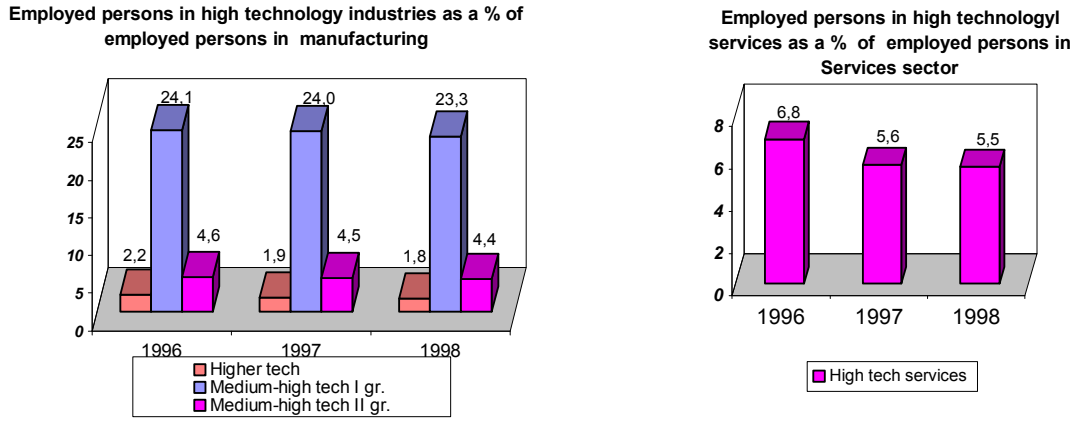
By comparison, in most European countries the number of employed persons in high technology industries and services increased in 1999, as average growth rates for EU member states were: 1.7% in and 6.4% respectively.

Structure of employment in the high technology sectors of manufacturing and services

The decrease of employment in the high technology industries in the period 1996 – 1998 did not cause changes in the distribution structure of employed persons in the three groups of high technology industries. In 1998 the number of employed in the medium-high tech I group industries was the largest: 168654 persons or 23.3% of total employment in manufacturing. The number of employed in the medium-high tech II group industries was five times less, 31573 persons, and the share of employed in the higher-tech industries was below 2%.

In 1998 employed persons in the high technology services accounted for 5.5% of the total number of employed in the Services sector, which is a decrease of 1.3 percentage points from 1996.

Figure 25 Employment in high tech sectors in Bulgaria



Source: National Statistical Institute.

Wages and salaries in the high technology sectors of manufacturing and services

In 1998, as in the previous two years, the average wages and salaries in five of the eight high technology industries remained below the average level in manufacturing, and in three of them was below the average country level.

In contrast to the world trend employed persons in the higher-tech industries to be better paid than those engaged in the medium-high tech I and II group ones, in Bulgaria they receive 5 to 10% lower wages and salaries than the average in manufacturing.

In 1998 the highest wages and salaries are earned in one of the medium-high tech II group industries - "manufacturing of other transport equipment", 45% higher than the average in manufacturing. Employed in the medium-high tech I group branch "manufacturing of chemicals and chemical products received 41% higher wages and salaries than the average for manufacturing. Employed in the high technology services are better paid than the average pay in the country, the only exception being those engaged in research services receiving about 3% lower wages and salaries than the country average.

Unemployment in the high technology sectors of manufacturing and services

In 1999 the number of unemployed in the high technology industries increased by 17.6% or 6,6 thousand persons from the previous year and reached 44,1 thousand persons. This is mainly due to the increase of unemployment in the medium-high tech I group industries: by 5,2 thousand.

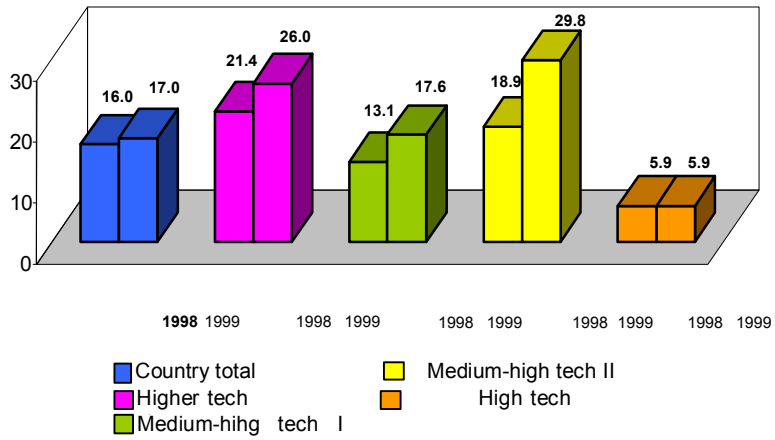
Unemployed persons in the medium-high tech II group industries rose by 1,6 thousand, a 25% increase on the previous year. Decrease in unemployment is realized in the higher-tech industries by 4.2% and in high technology services by 8.3%.

The increase of unemployment in absolute terms is coupled with higher unemployment rate in the high technology industries as whole: from 14.6% in 1998 to 19.7% in 1999, or 2.7 percentage points higher than the country average, 17.0%.

Unemployment rates in the three high technology industrial groups in 1999 were higher than the average country unemployment rate. Medium-high tech II group industries reached the highest unemployment rate: 29.8%, or 12.8 percentage points higher than the country average. Higher-tech industries ranked second with a 26.0% unemployment rate, or 9 percentage points above the country average, while the level of unemployment in the medium-high tech I group industries, 17.6%, is close to the country average unemployment rate of 17.0%.

Only the unemployment rate of the high technology services, 5.9% in 1999, was almost twice lower than that of the Services sector and about three times lower than the country average.

Figure 26 Unemployment rate in high technology industries and services



Source: National Statistical Institute

INVESTMENT

Expenditure on acquisition of tangible fixed assets in the high technology sectors of manufacturing and services

In 1998 investment activity in manufacturing increased compared with 1996. As a result the expenditure on acquisition of tangible fixed assets in the manufacturing reached 27.1% of total investment in the country, against 21.8% in 1996.

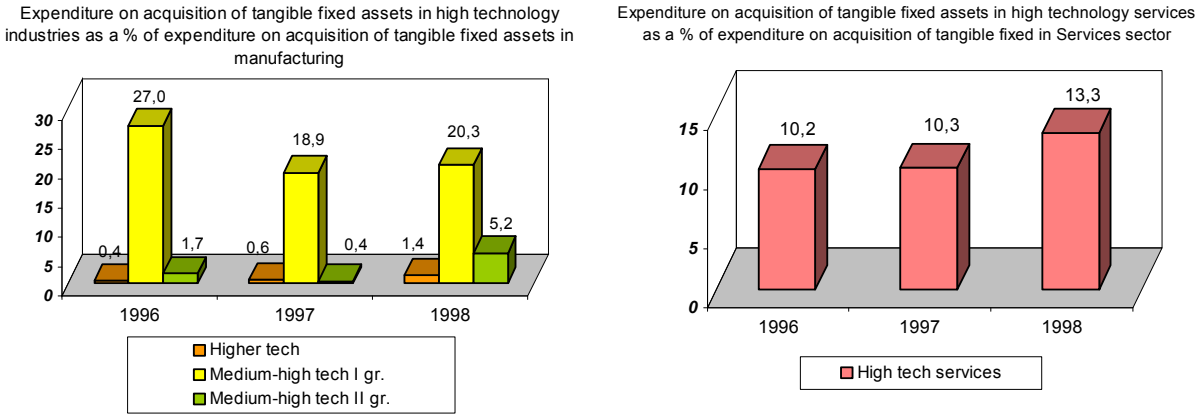
The major part of these expenditure, however, was not spent in the high technology industries, thus resulted to a drop in the share of investment in the high technology industries in manufacturing total: from 29.2% in 1996 to 26.9% in 1998.

In the period 1996 – 1998 no significant changes are observed in the structure of expenditure on acquisition of tangible fixed assets in the three high technology industrial groups. In 1998 medium-high tech I group industries accounted for the largest share in investment, 20.3% of total expenditure on acquisition of tangible fixed assets in manufacturing, but their relative share decreased by 6.7 percentage points from 1996.

Investment in medium-high tech II group industries increased from 1.7% in 1996 to 5.2% in 1998 and investment in higher-tech industries rose from 0.4% in 1996 to 1.4% in 1998.

A positive tendency is typical for investment in the high technology services. In 1998 they increased by 3.1 percentage points compared with 1996, totalling 232463.2 million Lv, which accounted for 13.3% of investment in the Services sector.

Figure 27 Expenditure of acquisition of tangible fixed assets in high-tech sectors



Source: National Statistical Institute.

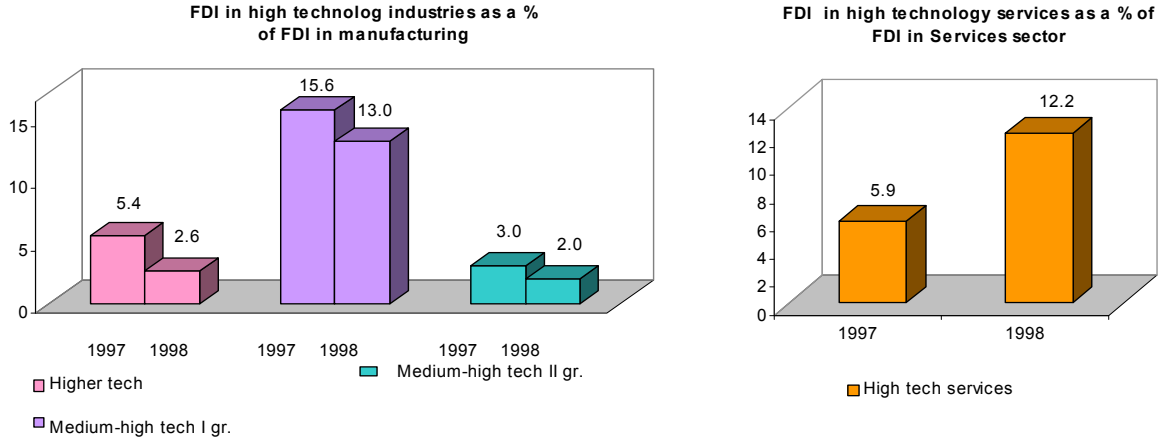
Foreign direct investment (FDI) in the high technology industries and services

In 1998 foreign direct investment flowed in the manufacturing amounted to 789732,5 thousand USD, accounting for 55.7% of overall Bulgarian FDI, against 39.0% in the previous year.

In contrast to the positive trend in manufacturing, in 1998 the share of foreign direct investment in the high technology industries decreased by 6.3 percentage points from the previous year. This is due to foreign investors' lower activity in each of the high technology industrial groups.

Medium-high tech I group industries attracted the largest share of foreign investment, 13.0%, within the manufacturing. The shares of higher-tech and medium-high tech II group industries were considerably smaller: 2.6% and 2% respectively. Foreign direct investment in high technology services rose significantly as a proportion in the Services sector, increasing from 5.9% in 1997 to 12.2% in 1998, mainly due to sizeable investments in the telecommunications.

Figure 28 Foreign direct investments in high-tech industries



Source: National Statistical Institute

High technology sectors grouping:

HIGH TECHNOLOGY SECTORS OF MANUFACTURING AND SERVICES

HIGHER TECHNOLOGY INDUSTRIES

- Manufacture of office machinery and computers
- Manufacture of radio, television and communication equipment and apparatus

MEDIUM - HIGH TECHNOLOGY I GROUP INDUSTRIES

- Manufacture of chemicals and chemical products
- Manufacture of machinery and equipment, n.e.c.
- Manufacture of electrical machinery and apparatus, n.e.c.

MEDIUM - HIGH TECHNOLOGY II GROUP INDUSTRIES

- Manufacture of medical precision and optical instruments, watches and clocks
- Manufacture of motor vehicles, trailers and semi-trailers
- Manufacture of other transport equipment

HIGH TECHNOLOGY SERVICES

- Post and telecommunications
- Computer and related activities
- Research and development

Abbreviations

EU – European Union
B – Belgium
DK – Germany
D – Denmark
EL – Greece
E – Spain
F – France
IRL – Ireland
I – Italy
L – Luxembourg
NL – The Netherlands
A – Austria
P – Portugal

BG - Bulgaria
CY - Cyprus
CZ – Czech Republic
EE - Estonia
HU - Hungary
LV - Lithuania
LT - Latvia
PL - Poland
RO - Romania
RU - Russia
SK - Slovakia
SI - Slovenia

Appendix 4 Statistical Data for Foreign Trade of Bulgaria with Technological Products - Tables

Marieta Tzvetkovska, researcher, Center for Economic Development

Table 38 Bulgarian foreign trade in High-tech products - Export&Import

	High Tech Sectors	**Export**				**Import**			
		1997		**1998**		**1997**		**1998**	
		USD mil	%	USD mil	%	USD mil	%	USD mil	%
27	Chemicals	909.2	18.5	608.2	14.7	486.2	9.9	506.6	10.6
34	Machines and appliances	256.2	5.2	264.9	6.4	385.7	7.9	418.8	8.7
35	Office equipment	20.8	0.4	10.5	0.3	70.0	1.4	87.6	1.8
36	Electrical machines	122.6	2.5	100.6	2.4	89.2	1.8	107.5	2.2
37	Radio, TV, telecommunication	28.6	0.6	12.9	0.3	89.0	1.8	133.0	2.8
38	Medical equipment	18.7	0.4	19.2	0.5	81.8	1.7	96.5	2.0
39	Car spare parts, etc.	30.7	0.6	24.0	0.6	126.3	2.6	224.7	4.7
40	Transport vehicles	88.8	1.8	88.9	2.1	27.1	0.6	40.2	0.8
	Total HT Products	1475.1	30.0	1129.2	27.3	1355.3	27.7	1614.9	33.6
	Total	4913.9	100	4139.2	100	4885.8	100	4797.7	100

Table 39 Bulgarian trade balance with high tech products

	High Tech Sectors	**Export**	**Import**	**Trade balance 1997**	**Trade balance 1998**
		Change98/97	**Change98/97**		
27	Chemicals	0.67	1.04	422.96	101.63
34	Machines and appliances	1.03	1.09	-129.46	-153.91
35	Office equipment	0.50	1.25	-49.25	-77.09
36	Electrical machines	0.82	1.21	33.34	-6.90
37	Radio, TV, telecommunication	0.45	1.49	-60.34	-120.06
38	Medical equipment	1.03	1.18	-63.09	-77.32
39	Car spare parts, etc.	0.78	1.78	-95.58	-200.70
40	Transport vehicles	1.00	1.48	61.69	48.69
	Total HT Products	0.77	1.19	120.27	-485.66
	Total	0.84	0.98	28.10	-658.50

Table 40 High-tech Products in first 50 export commodities

No		**Average export value (USD'000)**	**Share in total exports**
1.	Oil lubricants	225247.7	5.32
2.	Soda ash	66649.9	1.57
3.	Medicines	56851	1.34
4.	Tooth paste	37641.8	0.89
5.	Polyethylene	34535.6	0.82
6.	Bearings, gears, gearing elements	29921.4	0.71
7.	Ammonia nitrogen	29457.3	0.70
8.	Polypropylene	24450.5	0.58
9.	Ethylene glucole	23767.2	0.56
10.	Machine parts, apparatuses	18325.7	0.43
11.	Cosmetic products	17795.7	0.42
12.	Antibiotics	14844.9	0.35
	Total	**579489.2**	**13.68**
	% in first 50 commodities		**29.8**

Table 41 High-tech Products in first 100 export commodities

No		Average export value (USD'000)	Share in total export
1.	*Oil lubricants*	225247.7	5.32
2.	Ammonia	12632.8	0.3
3.	Sodium compounds	8941.9	0.2
4.	Soda ash	66649.9	1.57
5.	Tuluene	9760.8	0.2
6.	Ethylene glucole	23767.2	0.56
7.	Acryl-nitril	12566.9	0.3
8.	Antibiotics	14844.9	0.35
9.	Medicines	56851.4	1.34
10.	Calcium carbide	38191.8	0.9
11.	Ammonium nitrogen	29457.3	0.70
12.	Other chemical fertilizers	9481.1	0.2
13.	Paints and	8903.8	0.2
14.	Cosmetics	17795.7	0.42
15.	Tooth paste	37641.8	0.89
16.	Plaques and films	9291.2	0.2
17.	Polyethylene	34535.6	0.82
18.	Polypropylene	24450.5	0.58
19.	Hydraulic engines	8753.2	0.2
20.	Lifting machines	12997.0	0.3
21.	Parts for machines and apparatuses	18325.7	0.43
22.	Metal-working machine-tools	12831.0	0.3
23.	Tobacco processing machines	15443.6	0.36
24.	Bearings, gears, gearing elements	29921.4	0.71
25.	General purpose engines	10761.0	0.3
26.	Coachwork for motor vehicles	22508.7	0.5
27.	Ships and boats	37869.7	0.7
	Total	**756526.5**	**17.9**
	% of first 100	**28.8**	

Table 42 Main markets of Bulgarian high tech export by products

№	Products / Main markets	Value (USD'000)	Share of total export	№	Products / Main markets	Value (USD'000)	Share of total export
1.	*Oil lubricants*	225247,7	5,32	10.	*Machine parts*	18325,7	0,43
	Yugoslavia	84879,9	2,0		Germany	3534,1	0,1
	Slovenia	33159,0	0,8		Poland	2411,4	0,1
	Italy	31790,1	0,8		Russia	1675,3	
	Turkey	24186,1	0,6		Hungary	993,2	
	Macedonia	11547,3	0,3		Ukraine	588,1	
	Great Britain	10334,3	0,2		Check Republic	557,5	
2.	*Soda ash*	66649,9	1,57	11.	*Cosmetics*	17795,7	0,42
	Turkey	19855,4	0,5		Russia	10692,4	0,3
	Italy	7428,1	0,2		Ukraine	3408,3	0,1
	Israel	5759,2	0,1		Rumania	2395,7	0,1
	Greece	5210,1	0,1		Georgia	1114,5	
	Spain	4247,1	0,1				
	France	2826,4	0,1				
3.	*Medicines*	56851,4	1,34	12.	*Antibiotics*	14844,9	0,35
	Russia	22685,3	0,5		Germany	4376,3	0,1
	Ukraine	4653,5	0,1		Italy	2086,7	
	Albania	2411,3	0,1		Spain	2048,4	
	Latvia	1602,6			Austria	1878,5	
	Poland	1593,4			Belgium	877,8	
					Nitherlands	723,8	
4.	*Calcium carbide*	38191,8	0,9	13.	*General purpose engines*	10761,0	0,3
	Spain	2143,8			Germany	2254,5	
	Macedonia	1913,9			Italy	2225,9	
	Yugoslavia	1653,5			Sweden	894,4	
	Turkey	1287,6			France	842,9	
	Greece	1145,3			Spain	574,1	
	Italy	937,5			Austria	334,1	
5.	*Tooth paste*	37641,8	0,89	14.	*Metal-working machine-tools*	12831,0	0,3
	Russia	19513,6	0,5		Italy	2176,3	
	Ukraine	6051,9	0,1		Germany	1525,4	
	Check Republic	971,8			Egipt	1041,5	
	Romania	924,2			USA	802,2	
	Lithuania	741,9			Spain	758,7	
6.	*Polyethylene*	34535,6	0,82	15.	*Lifting machines*	12997,0	0,2
	Greece	8800,4	0,2		Hungary	1284,9	
	Italy	5853,6	0,1		Russia	971,4	
	Yugoslavia	3138,8	0,1		Poland	885,4	
	Macedonia	2998,1	0,1		Italy	805,1	
	Germany	1541,9			Germany	685,1	
	Belgium	1432,6					
7.	*Ammonia nitrogen*	29457,3	0,70	16.	*Other chemical fertilizers*	9481,1	0,2
	Greece	2532,8	0,1		Mexico	3471,3	
	Italy	1436,7			Italy	2104,6	
	Macedonia	1258,5			Greece	844,3	
	France	1038,6			Macedonia	797,1	
					USA	762,1	
					Spain	558,3	
8.	*Polypropylene*	24450,5	0,58	17.	*Ships & boats (building $ repairing)*	37869,7	0,7
	Turkey	13432,7	0,3		Nitherlands	1316,9	
	Greece	965,8			Monaco	950,0	
	Yugoslavia	885,9			Liberia	576,6	
	Macedonia	705,0			Germany	492,7	
	Rumania	589,1			Greece	351,4	
					Turkey	239,2	
					Georgia	224,8	
9.	*Ethylene glucole*	23767,2	0,56				
	Italy	13181,1	0,3				
	Belgium	1321,1					
	Spain	1020,7					
	Greece	763,7					
	Macedonia	612,6					

Appendix 5 Statistical data for SMEs in High-tech Sectors - Tables

Diana Hristozova, senior researcher, Center for Economic Development

Table 43 Distribution of enterprise by number of employed, economic sectors and activity groupings in 1998

Number of employed		До 10	11-50	51-100	101+
Total	**%**	**92.4**	**5.4**	**1**	**1.2**
Industry	**%**	**79.5**	**12.6**	**3.3**	**4.6**
NACE 24 (NOC27): Chemicals and chemical products	%	69.4	17	4.9	8.7
NACE 29 (NOC34): Machinery and equipment n.e.c.	%	73.8	13.4	3.8	8.9
NACE 30 (NOC35): Office machinery and computers	%	76.3	15.1	3.9	4.6
NACE 31 (NOC36): Electrical machinery and apparatus	%	76	12.4	4.2	7.4
NACE 32 (NOC37): Radio, television and communication equipment and apparatus	%	78.7	10.6	4.3	6.3
NACE 33 (NOC38): Medical, precision and optical instruments, watches and clocks	%	87.1	7.6	2.2	3.2
NACE 34 (NOC39): Motor vehicles, trailers and semi trailers	%	60.2	24.6	5.1	10.1
NACE 35 (NOC40): Other transport equipment	%	90.3	5.5	0.8	3.4
Services	**%**	**96.3**	**3**	**0.4**	**0.3**
NACE 64 (NOC68): Post and telecommunications	%	76.2	18.2	2.8	2.9
NACE 72 (NOC76): Computer and related activities	%	95.1	4.5	0.2	0.1
NACE 73 (NOC77): Research and development	%	47.4	36.2	9.5	6.9

Source: National Statistical Institute

Table 44 Distribution of employed by size of enterprises, economic sectors and activity groupings in 1998

Number of employed		1-10	11-50	51-100	101+
Total	**%**	**20.5**	**14.5**	**9.1**	**56**
Industry	**%**	**6.9**	**10.5**	**8.6**	**74**
NACE 24 (NOC27): Chemicals and chemical products	%	2.2	4.5	4	89.3
NACE 29 (NOC34): Machinery and equipment n.e.c.	%	3.2	5.9	5.1	85.7
NACE 30 (NOC35): Office machinery and computers	%	5.4	8.9	8	77.7
NACE 31 (NOC36): Electrical machinery and apparatus	%	5	7.3	8.3	79.3
NACE 32 (NOC37): Radio, television and communication equipment and apparatus	%	6.9	9	10.8	73.3
NACE 33 (NOC38): Medical, precision and optical instruments, watches and clocks	%	11.4	11.5	10.1	66.9
NACE 34 (NOC39): Motor vehicles, trailers and semi trailers	%	2.3	9.7	5.9	82
NACE 35 (NOC40): Other transport equipment	%	4.3	4.1	1.8	89.9
Services	**%**	**43**	**16.2**	**7**	**33.7**
NACE 64 (NOC68): Post and telecommunications	%	2	3.3	1.6	93.1
NACE 72 (NOC76): Computer and related activities	%	53.6	28.5	4	13.9
NACE 73 (NOC77): Research and development	%	4.2	30	22.7	43.2

Source: National Statistical Institute

Table 45 Turnover structure by size of enterprises, economic sectors and activity groupings in 1998

Number of employed		1-10	11-50	51-100	101+
Total	**%**	**22**	**17.5**	**6.7**	**53.8**
Industry	**%**	**5.2**	**7.6**	**5.7**	**81.4**
NACE 24 (NOC27): Chemicals and chemical products	%	1.6	3.3	3	92.1
NACE 29 (NOC34): Machinery and equipment n.e.c.	%	4.4	6.8	4.2	84.6
NACE 30 (NOC35): Office machinery and computers	%	22.7	15.9	20.6	40.8
NACE 31 (NOC36): Electrical machinery and apparatus	%	6.4	8	5.1	80.5
NACE 32 (NOC37): Radio, television and communication equipment and apparatus	%	13.8	12.8	7.6	65.8
NACE 33 (NOC38): Medical, precision and optical instruments, watches and clocks	%	19.6	16.3	8.4	55.7
NACE 34 (NOC39): Motor vehicles, trailers and semi trailers	%	3.6	20.1	5	71.3
NACE 35 (NOC40): Other transport equipment	%	3.7	3.9	0.3	92.1
Services	**%**	**37.6**	**25.1**	**6.8**	**30.4**
NACE 64 (NOC68): Post and telecommunications	%	1.2	3.5	0.9	94.4
NACE 72 (NOC76): Computer and related activities	%	48.9	27	10.2	13.8
NACE 73 (NOC77): Research and development	%	5.8	27.7	21.7	44.7

Source: National Statistical Institute

Table 46 Average turnover per enterprise by size of enterprises, economic sectors and activity groupings in 1998

Number of employed		1-10	11-50	51-100	101+
Total	**m lv.**	**47.3**	**641.6**	**1281**	**9355.9**
Industry	**m lv.**	**36.1**	**331.7**	**963.9**	**9660**
NACE 24 (NOC27): Chemicals and chemical products	m lv.	60.6	515	16114	27808.3
NACE 29 (NOC34): Machinery and equipment n.e.c.	m lv.	34.9	299.8	644.1	5600.4
NACE 30 (NOC35): Office machinery and computers	m lv.	150.3	530.1	2653.2	4476.8
NACE 31 (NOC36): Electrical machinery and apparatus	m lv.	45.7	348.5	664.9	5937.6
NACE 32 (NOC37): Radio, television and communication equipment and apparatus	m lv.	38.3	262.5	393.4	2258.1
NACE 33 (NOC38): Medical, precision and optical instruments, watches and clocks	m lv.	33.2	318.7	566	2589.2
NACE 34 (NOC39): Motor vehicles, trailers and semi trailers	m lv.	32.8	452.4	550.2	3886
NACE 35 (NOC40): Other transport equipment	m lv.	29.1	503.7	282.9	19258.3
Services	**m lv.**	**49.6**	**1056.2**	**2261.1**	**12634.7**
NACE 64 (NOC68): Post and telecommunications	m lv.	40.9	519.9	896.4	90152.2
NACE 72 (NOC76): Computer and related activities	m lv.	24	280.1	2418.1	4379.9
NACE 73 (NOC77): Research and development	m lv.	30.8	193.3	577.3	1638.6

Source: National Statistical Institute

Table 47 Average turnover per employed by size of enterprises, economic sectors and activity groupings in 1998 average per the activity grouping = 100

Number of employed		1-10	11-50	51-100	101+
Total					
Industry					
NACE 24 (NOC27): Chemicals and chemical products	100	72	75	75	103
NACE 29 (NOC34): Machinery and equipment n.e.c.	100	135	115	82	99
NACE 30 (NOC35): Office machinery and computers	100	424	178	257	53
NACE 31 (NOC36): Electrical machinery and apparatus	100	127	109	62	102
NACE 32 (NOC37): Radio, television and communication equipment and apparatus	100	199	142	71	90
NACE 33 (NOC38): Medical, precision and optical instruments, watches and clocks	100	171	141	83	83
NACE 34 (NOC39): Motor vehicles, trailers and semi trailers	100	152	206	86	87
NACE 35 (NOC40): Other transport equipment	100	85	95	17	103
Services					
NACE 64 (NOC68): Post and telecommunications	100	57	108	57	101
NACE 72 (NOC76): Computer and related activities	100	91	95	253	100
NACE 73 (NOC77): Research and development	100	139	93	96	104

Source: National Statistical Institute

Table 48 Operational probability by size of enterprises, economic sectors and activity groupings in 1998 (lv.)

Number of employed		1-10	11-50	51-100	101+
Total		**4.8**	**1.9**	**1.7**	**5.1**
Industry		**8.6**	**2.9**	**2.8**	**4.9**
NACE 24 (NOC27): Chemicals and chemical products		3.3	5.6	4.1	-0.5
NACE 29 (NOC34): Machinery and equipment n.e.c.		13.8	4.3	1.6	3.8
NACE 30 (NOC35): Office machinery and computers		2.2	1.8	-1.2	-12.1
NACE 31 (NOC36): Electrical machinery and apparatus		14.9	4.8	2.6	5.2
NACE 32 (NOC37): Radio, television and communication equipment and apparatus		-1.2	4.4	3.4	-7.1
NACE 33 (NOC38): Medical, precision and optical instruments, watches and clocks		11.8	8.6	-8.1	4.1
NACE 34 (NOC39): Motor vehicles, trailers and semi trailers		-12.2	0	7.8	-0.7
NACE 35 (NOC40): Other transport equipment		12	2.4	-39.5	10.5
Services		**4.3**	**2.2**	**1.2**	**5.7**
NACE 64 (NOC68): Post and telecommunications		4.6	2.6	0.8	25.7
NACE 72 (NOC76): Computer and related activities		10.7	2.1	4	4.8
NACE 73 (NOC77): Research and development		-16.4	-1.9	-1.9	6.1

Source: National Statistical Institute

Appendix 6 Foreign Trade Regime of Bulgaria

Marieta Tzvetcovska, researcher, Center for Economic Development

The tariff and trade policy Bulgaria follows by applying an adequate foreign trade regime and customs tariffs is a significant part of country's economic reconstruction aimed at achieving economic stability and development. All changes in the foreign trade regime during the last several years were tied to specific stages in the development of the national economy and market and were designed to set the stage for competitive production. The main task was to promote a balance between safeguarding employment and incomes and promoting national competitiveness on the basis of openness towards the dynamic impact of global competition. This has been a long process of continuing changes in the foreign trade regime towards reducing restrictions and quantitative limitations tied to the changes in internal market conditions.

Until 1998 temporary changes were made in the tariffs depending on the appearance of shortages or surpluses in the supply of certain goods, mainly consumption goods. These measures helped achieve stability in the domestic market for agricultural products and harnessed the inflationary processes.

Exports of high tech products are free of export fees and Bulgaria does not apply any quantitative restrictions on imports and exports. Where international agreements provide for the use of quotas, a non-automatic licensing regime is applied to the transactions within those quotas. The government issues permits in respect to transactions with a limited number of goods related to the protection of the life and health of humans, the flora and the fauna as required under GATT rules.

Substantial progress has also been achieved in respect to the use of **non-tariff measures**. Any current bans on exports and imports are based either on law, on an international instrument or on a special enactment of the government. The registration regime of exports and imports is solely used for monitoring trade in most commonly used goods. The range of products covered by this regime has been reduced considerably. The regime of permits for the import, export or transiting of certain goods is used exclusively for protecting public morals, public order and national security, the life and health of humans, the flora and fauna, as well as for safeguarding national artistic, historical and architectural masterpieces. The procedure for issuing certificates has been streamlined and both the waiting period (now of only two days) and the number of authorising bodies have been reduced. As a result of further foreign trade regime liberalisation, licensing was replaced with registration in respect to transactions involving the export or import of precious metals and gemstones and the exports of unprocessed timber. The number of goods that are subject to registration regime was reduced substantially.

Registration did in fact help collect early information on exports and imports (particularly of sensitive goods) and somewhat alleviated the situation caused by the delays in the processing of the customs statistics. For statistical purposes the removal of the registration regime will be compensated partly by the introduction of an *integrated system for processing customs statistical information.* This system will permit to monitor the flows of products that are considered sensitive in respect to the domestic market. The first stage of the integrated customs information system entered into operation recently. By the end of the year this system will cover 90 per cent of the entire document turnover.

All changes in country's foreign trade regime are aimed at further liberalisation of foreign trade. They are expected to play an important role for strengthening investment interest in Bulgaria, increasing productivity and competitiveness of Bulgarian export products, as well as, for improving their access to foreign markets and facilitating economic growth in general.

Customs Tariffs

The introduction of a liberal and stable foreign trade regime is closely tied to ***making the customs tariff a primary tool of national trade policy***. The Bulgarian customs tariff is based entirely on the Harmonised Commodity Description and Coding System of the Customs Cupertino Council, Brussels. The customs tariff consists of two columns: the first one is applied to most favoured nations, and the second provides preferential treatment, known as UNCTAD-GSP. There are tariff quotas with reduced import duties in

accordance with Bulgaria's WTO obligations. Lower duties for the EU, EFTA, CEFTA, Turkey, and FYR Macedonia are applied.

The tariff regime was simplified and made less burdensome with a reduction in the number of tariff bands, the dispersion of rates, and by corrections in the levels of certain tariffs. The measures included in the Customs Tariff are exhaustive, predictable and are directed at achieving a ***stable and predictable trade policy.*** Pursuant to the commitments made under the three-year agreement with the IMF and within the framework of the WTO, both the average rates in respect to most favoured nations and the maximum customs rates are the subject of annual reductions.

As of the beginning of the year 2000 the average rate in respect to most favoured nations has been 13.88 per cent (it stood at 15.2 per cent in 1999 and 17.85 per cent in 1998), including for industrial goods: 10.99% (from 12.56 and 15.25 per cent for the two previous years respectively); and for agricultural products: 24.00 per cent (from 24.61 and 27.31 per cent). One should not overlook the fact that industrial goods make up about 90 per cent of the country's imports while agricultural products account for just 10 per cent of the imports. Currently the maximum rate is 30 per cent for industrial goods and 74 per cent for agricultural products. The number of customs rates has already been reduced to 25.

Industrial goods that are manufactured in Bulgaria (lighting, furniture, glassware and ceramics, china, textiles, shoes, laundry detergents and paper) are subject to the highest duties. These amount to about 10 per cent of all products. At the same time, almost 16 per cent of all goods are not subject to any duties. This group of goods includes raw materials and equipment used for power generation, medications, computers and telecommunications equipment. 18.3 per cent of all imports of industrial goods are subject to the lowest 5 per cent rate, 23.3 per cent are subject to the 10 per cent rate, and 15.5 per cent of these imports are subject to the 15 per cent rate.

As trade with the EU continues to rise and pursuant to the obligations under the European Agreement, tariffs on imports from the European Union have been reduced substantially (with most industrial imports being duty free). The tariff reductions are also consistent with the agreements with the WTO, EFTA, and CEFTA. Thus, the average rate in respect to industrial imports for the EU countries as of the beginning of the year 2000 has been 2.09 per cent, 2.08 per cent in respect to the EFTA countries, 1.97 per cent in respect to Turkey, 0.92 per cent for Hungary, 0.08 per cent for Poland, 0.01 per cent for Romania and 4.98 per cent for Macedonia. Imports of industrial goods from the Czech Republic, Slovakia and Slovenia are free of duties.

The average weighed duty on imports in the first half of 1999 (excluding the preferential regime) was 8,56 per cent (7,05 per cent for industrial goods and 24,3 per cent for agricultural products.). If one should include the preferential treatment provided under various free trade agreements, the average weighed duty would be even lower since more than 60 per cent of the trade is with countries that have such agreements with Bulgaria.

The most important actions in the field of foreign trade policy are aimed at ***the further reduction of the customs rates for certain kinds of products and at narrowing the differentiation in the duties levied on certain goods imported from the various groups of countries.*** Currently a study is under way of the possibilities to have those goods that are not of strategic importance for manufacturing but are subject to the foreign trade regime together with the goods that have been exempt from import duties for a long time to be listed at zero or reduced rate in the Customs Tariff and its annexes. Further reduction of duties on imports of products and raw materials not produced domestically is now being considered for the purpose of facilitating the restructuring of the Bulgarian economy. This will help achieve greater stability and predictability of the foreign trade regime and will be conducive to eliminating any biases in its application.

Trade agreements

As most high tech products are traded on the EU market and former CMEA countries signing of trade agreements, regulating bilateral trade is a significant step towards increasing total turnover, promotion of technological development and raising national competitiveness.

Bulgaria's relations with the **European Union** are based on the country's association agreement with the EU, which was signed on March 8, 1993 and entered into force on February 1, 1995. Under the provisions of this agreement Bulgaria and the Union have committed themselves to establishing a free trade zone within a transitional 10-year period under GATT rules. The asymmetry of the reduction of import duties in favour of Bulgaria created an opportunity for the duties and fees of equal effect in respect to industrial goods made in Bulgaria and exported to the EU to be eliminated by the end of 1998. In fact the duties on Bulgarian industrial goods were lifted as early as January 1, 1998.

At present imports of industrial goods, including high tech products originating from the EU are subject to duties under three liberalisation schemes:

- - zero customs duty for the goods in the first liberalisation scheme in force immediately after conclusion of the Agreement (machinery and equipment, fertilisers, plastics and a few others);
- - zero customs duty for the goods in the second liberalisation scheme (motor vehicles, certain non-organic acids, laundry detergents, watches, watch and clock movements, etc.).
- - 30 per cent of the base duties as of January 1, 2000 on the goods in the third liberalisation scheme (medications, mineral fertilisers, chemical nitric fertilisers, household appliances, electric motors and transformers, medical and surgical instruments, etc.).

Thus in effect a free trade zone for industrial goods has been established as a result of the complete elimination by the two parties of all customs duties and equal fees on these goods.

Rapid growth of trade with EU gives us the opportunity to make some conclusions. First, the removal of most tariff and non-tariff restrictions to imports from the EU is indicative of the capability of the Bulgarian economy to face the challenges of competitive pressures.

Second, the growth of the EU share in Bulgaria's exports is largely the result of the successful adaptation of Bulgarian producers to the requirements of the West European market. Third, the application of all regimes and measures which the EU applies in respect to third countries and the getting in line of commercial contracts with EU law is already under way and no significant difficulties are anticipated in the course of its implementation.

Bulgaria is a party to the multilateral free trade agreement between the member-countries of **EFTA**. Pursuant to this agreement as of January 1, 1998 Bulgarian industrial goods can be imported into EFTA free of customs duties. Bulgaria equalised its preferential treatment of the EU and EFTA in the imports of agricultural goods and unilaterally lifted the customs duties on the imports of certain kinds of textile products originating from EFTA for the purpose of granting equal customs regime with that provided to the EU. The continuing liberalisation within EFTA provides for establishing a free trade zone between the five countries on January 1, 2002.

On July 17, 1998 Bulgaria signed an agreement to join **CEFTA**. It's member-countries committed themselves during the period of transition to gradually eliminate all import and export duties and equivalent fees, quantitative restrictions and other similar measures and to refrain from introducing such measures in the trade among them. The implementation of this commitment in respect to concrete products and the deadlines for the elimination of the customs duties are negotiated on bilateral basis.

As of January 1, 1999 the customs duties on more than 80 per cent of all industrial goods were lifted. The duties levied on the remaining kinds of products will also be lifted and the current rates of the duties stand at 25 to 60 per cent of the base rates. The **trade in industrial goods between the member-countries will be free of all duties as of January 1, 2002**. As far as the trade in agricultural products is concerned, the Agreement provides for the creation of three groups of products: goods with zero duties; goods traded at lower uniform duties; and goods for the trade in which the countries provide each other concessions on a bilateral basis.

Bulgaria's accession to CEFTA creates an impetus to its trade with those countries. Certain increase in the volume of trade was in fact achieved mostly in the form of imports from CEFTA countries. The reduction or lifting altogether of duties on the imports of certain Bulgarian industrial goods has improved

market access and removed discrimination in respect to other Eastern European products but has not led automatically to any substantial increase in the demand for Bulgarian products. This is due to the different export potentials resulting from the varying rates at which the national economies are revived as well as from the slower rate of the reform in Bulgaria compared to the other CEFTA countries.

Bulgaria signed an agreement on **establishing a free trade zone with Turkey** on July 11, 1998. 90 per cent of Bulgaria's exports of industrial goods to Turkey have become duty-free as of its entry into effect on January 1, 1999. The two countries have undertaken to fully liberalise their trade in industrial goods by January 1, 2002. As far as the trade in agricultural products is concerned, the two countries will gradually reduce customs duties within the framework of the agreed tariff quotas.

The agreement on **free trade with Macedonia** was signed on October 13, 1999 and entered into effect on January 1, 2000. It provides for the development of a free trade zone by January 1, 2005.

All this has provided grounds for assuming that the active trading policy directed at setting up free trade zones on bilateral basis for removing non-tariff obstacles to the development of trade is a step in the right direction. The negotiations on setting up free trade zones with other Balkan states are still at the stage of expert evaluation and further development of these projects is anticipated. Progress has been achieved in the preparatory work on new free trade agreements with Israel, Morocco, Lithuania, Latvia and Estonia.

Membership in the WTO

One of the top priorities of Bulgaria's multilateral trade and economic policy is its equal participation in the process of further liberalisation of world trade. The membership of Bulgaria in the WTO is a legislative foundation for regulation of its economic relations with the rest of the world. The advantages provided by this membership are increased access for Bulgarian exports to the national markets of the WTO member-countries and progressive lowering of the tariff and non-tariff barriers, as well as granting of national treatment to Bulgarian goods (and subsequently capital, services and workforce) in those markets.

Bulgaria participates in the WTO negotiations on the further **liberalisation of trade with basic telecommunications**. Under the agreement on basic telecommunications from the fourth protocol on services, Bulgaria is obliged to liberalise its public voice phone, telegraph and telex services as of 2003. This is also true of the digital and analogue cellular phones.

In view of the **trade related aspects of intellectual property rights**, Bulgaria's legislation was amended and upgraded recently so that the modern patent and copyright laws and criminal penalties have brought Bulgarian intellectual property legislation in line with European law. On joining the World Trade Organisation Bulgaria agreed to implement the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) without a transitional period.

Recognising the importance of **information technologies** for the successful development of the economy and its adaptation to world economic trends, Bulgaria started preparatory work for joining the ministerial declaration on trade with IT products adopted at the first session of the WTO Ministerial Conference in Singapore in 1996.

Liberalisation of foreign trade, negotiation of favourable concessions through free trade agreements and firm observance of the commitments towards WTO paves the way for further increase of foreign trade in high tech products.

Appendix 7 Overview of the Bulgarian Tax System

Lora Brusiiska, researcher, Center for Economic Development

The current tax regime in Bulgaria doesn't treat technology sector and investment in R&D differently at all. The tax legislation doesn't provide any incentives and tax relieves for R&D expenditures or for improvement of the technology environment for the business.

The Bulgarian tax system is to a great extent in line with European standards. Taxes are levied on income – both personal and corporate, consumption, and property.

Some of the major principles of Bulgarian tax regime are: neutrality (lack of tax exemptions and relieves), yearly taxation of income and property, self-taxation (every taxpayer declares his obligation to the state himself), and a tendency toward decreased differentiation in rates.

Since the beginning of the economic reforms, tax legislation has been changed due to short-term, mainly fiscal reasons. Due to the overall macroeconomic stability in the last years the tax laws have been adjusted to the new conditions and to achieve the major goal of the fiscal policy – sustainable economic growth.

Corporate Income Tax

Taxable income

All companies and partnerships, including non-incorporated partnerships, are liable to pay corporate income tax on all sources of income. The corporate income tax rate is 25% (see Current Tax Regime Achievements). For companies with taxable profits of up to 50,000 leva the tax rate is 20%. In addition, a 10% municipal tax is charged on all taxable corporate income that is, however, deductible from the taxable base. Consequently the aggregate tax rate (including corporate and municipal tax is 32.5%, and 28% for companies with taxable profits of up to 50,000 leva.

Non-taxable corporate income is classified as follows:

- The profits of commercial companies distributed in the form of new quotas and shares in commercial companies, as well as the profits distributed in the form of an increase in the par value of existing quotas and shares;
- Distributed profit through which a company's capital has been increased by new shares and quotas or the capital has been increased as a result of the par value of the existing quotas and shares.

Specific Tax Regimes

Company expenses. Entertainment and representative expenses, sponsorships and business gifts, that do not bear the trademark of the donating company, are subject to a tax rate of 25%. Bonuses to staff, benefits in kind, expenses associated with maintenance, repair and use of cars is taxed at a rate of 20%.

Property tax is 0.15%. If the owner is a company, the tax base is the book value of the property.

Capital Gains. Capital gains tax is levied on the difference between the market value and the book value of the financial assets of a Bulgarian company that are distributed to shareholders on the company's liquidation. The tax rate is 15%.

A 15% final withholding tax is imposed on gains derived by non-residents from disposals of shares and securities of Bulgarian companies, real estate and financial assets. The tax is imposed on the difference between the sales price and the book value of the assets. Residents include such gains in their taxable income.

Dividends. Dividends received by local companies or by certain charities are not subject to withholding tax. Dividends payable by local companies (including to foreign shareholders) are taxes at 15% withholding tax.

Stock dividends. Dividends capitalised into shares are not subject to withholding tax.

Tax exemptions. The Bulgarian Government provides a tax incentive for companies investing in depressed regions. Depressed regions are defined as regions with high unemployment, generally exceeding one and a half times the average unemployment rate for the country. Companies investing in these regions enjoy a reduced corporate income tax rate, provided:

- The investment being made is in the form of an acquisition, modernisation or reconstruction of tangible fixed assets (buildings, equipment, transmitters, electricity transmitters, and telecommunication lines); and
- The funds for the investment are derived from contributions made by shareholders for the acquisition of new shares.

In such cases, the corporate tax rate is reduced in the amount equivalent to 10 percent of the amount of the share contributions used in the above manner. The municipal tax rate of 10 percent is not affected.

Withholding tax. Royalties, fees for technical services, rents and interest are subject to 15% tax if the treaties for avoidance of double taxation do not provide for lower rates. The following income originating in Bulgaria and payable to foreign entities is subject to a 15% withholding tax:

- Dividend and liquidation proceeds;
- Interest, including finance lease agreements;
- Capital gains on the sale of immovable property, stakes in a limited liability companies capital, securities and financial assets.

A certain group of corporations and sole proprietorships is subject to the so-called "lump taxation." Companies engaged in certain fields of activities are obliged to pay an annual fixed tax. The whole list of activities is explicitly detailed in the Law on Personal Income Taxation.

Representative expenses. These are taxed with a final tax amounting to 25%. Representative expenses with the trademark or the registered name of the person are not subject to tax.

Social expenses. Such expenses are taxed with a 20% withholding tax in case they represent additional cash or in-kind remuneration for the personnel.

Expenses for car maintenance. All car related expenses are taxed with a final tax at the rate of 20%, if they relate to administrative and management activity.

Limitation of deductible expenses. There are regulations for daily expenses for business trips. Donations are limited to up to 5% of income before tax adjustments. Interest expenses are deductible to up to a maximum amount equal to the interest income plus 50% of the profits before tax (less interest income and expenses), unless the company's equity capital exceeds its borrowed capital.

Tax reserves. Only 70% of the trade provisions accrued by non-financial institutions are tax deductible. Provisions accrued by banks covering 100% of bad debts are deductible up to 10% of the total amount of the extended debts.

Depreciation. Companies choose the method for depreciation freely. For tax purposes, however, straight line method should be applied. Tax permitted depreciation rates are as follows:

- 20% for machinery, product equipment, computers and software;
- 15% for all depreciable assets in cases where specific rates are not provided;

- 8% for vehicles (exclusive of automobiles);
- 4% for buildings, facilities, installations, electric wires and lines of communication.

For certain types of assets such as water and steam pipes, increased depreciation rates may be applied using the declining balance method.

Trading losses. Trading losses may be carried forward for five subsequent tax years. This relief applies to all kinds of commercial companies as well as to branches and permanent establishments of foreign companies. Banks may carry their losses forward for 10 consecutive years. Losses from previous years may be offset against positive financial results upon the determination of the quarterly advance payments.

Thin capitalisation. The maximum allowed amount of interest expenses on additional capital instalments, loans from the shareholders, third party loans, as well as bank loans and interest in respect of financial leases for each tax period shall not exceed the interest income, increased by 50% of the positive financial result, less interest income and expenses. Thin capitalisation rules should not be applied where the borrowed capital of a company does not exceed its equity capital.

Transfer pricing. Transfer pricing rules allow the tax authorities to adjust taxable profits where transactions between related parties are not made at arm's length. This right to adjust profits is extended to transactions between Bulgarian branches and their foreign head offices.

Tax holidays. A tax holiday for corporate and municipal taxes is granted to specialised enterprises of disabled persons. Agricultural producers are also entitled to a profit tax disposition or their profits derived from sales of raw agricultural products.

Personal Income Taxation

The Bulgarian personal income tax is based on the domicile principle. Local persons are taxable for their world-wide income, while foreign persons are taxed on income derived in Bulgaria. Local persons, once taxed abroad, may retrieve the tax paid on income in the other country up the limit of their obligation according to the Bulgarian legislation.

The PIT is rather neutral – with no or few incentives.

Personal income taxation is based on the annual calculation of gross income received. Monthly advance payments are applied to wage-earners, and a 15-percent advance instalment for all others, once the accumulated income exceeds the tax-exempt level.

Gross income for taxation includes income derived from wages, activities as a sole proprietor, handicrafts, services, “free-lance” professional fees, copyright remuneration, rent or other incomes, not explicitly mentioned as “exempt income.” Non-taxed incomes are: pensions, scholarships, interest on bank deposits and government securities, dividends already taxed at the source, and inherited income (local inheritance tax is due, however).

Income Liable to Tax

Individuals are subject to the following taxes on income:

- Employment income is subject to a tax on wages and salaries. This is applied according to a progressive scale, with the maximum marginal rate of 40% (see Current Tax Regime Achievements) levied on monthly taxable income in excess of 1400 leva. Tax on employment income is withheld by the employer at source;
- Non-employment income is subject to tax according to an annual progressive scale with a non-taxable limit of up to 960 leva. Certain statutory allowances are applicable before tax. Advance tax withholding at the rate of 15% is required for recipients of such income; the advance withholding shall be made by the payer of the income if it is a legal entity;

- 15% withholding tax is levied in payments of dividends, interest, rents, royalties, capital gains and fees for technical services made by a local legal persons to non-resident individuals.

For specific types of income we have the following tax rates:

- Interest payments – 20% withholding taxes on the amount above 60 leva
- royalty payment and technical services fees – 15% withholding tax is levied when paid on non-Bulgarian tax residents
- payments under lease, factoring and franchising contracts – 20% withholding tax on the amount above 60 leva
- Income from civil contractors – 15 % advance tax payment is due upon payment. The pre-paid is set off against the final tax obligation. 35% of the income is regarded as non-taxable.
- Other income – Income not addressed by the PITA and income from occasional transactions – 20% withholding tax on the amount above 60 leva.

Deductions

Employment income. Certain non-taxable items are excluded from taxable income, as well as the mandatory and voluntary health, pension and social security insurance contributions.

Other deductions. Statutory deductions are provided for different types of income (e.g. 35% for free lancers; 25% for managers, members of controlling, supervisory and other ruling bodies, 50% for royalties).

Deduction for donations are also allowed provided certain conditions are met.

Exempt Income

Exempt income includes bank interest, pensions, scholarships, certain state welfare payments, unemployment compensation, compensation for professional illness or death, etc. Capital gains may also be tax exempt provided certain conditions are met.

Indirect Taxes

Value Added Tax is levied on the domestic transactions and exports performed by VAT liable persons, as well as on import of goods. The general VAT rate is 20% on the value of the transaction (including all taxes, fees, financing, subsidies and interest related to the supply). Export transactions are zero rated. All enterprises carrying out independent economic activities are liable to VAT, should their taxable turnover for the last 12 months be more than 75 million leva.

Optional registration is available in the case of a lower taxable turnover provided the person has performed export supplies for more than 50 million leva.

